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POLYOSTOTIC FIBROUS DYSPLASIA*

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THE roentgen demonstration of skeletal abnormalities is often the first tangible evidence of an underlying systemic disorder that would go undetected if dependent upon clinical manifestations alone. This is particularly true of that ever increasing group of diseases in which an osteitis fibrosa is one of the somatic manifestations. While osteitis fibrosa roentgenographically may not always be recognized as such, the appearance of the involved bones leaves little doubt as to the existence of some grave and fundamental disturbance. This lesion has assumed increasing importance both clinically and roentgenologically since the discovery that osteitis fibrosa is often the skeletal manifestation of an existing parathyroid tumor. A few years ago this knowledge gave us a new disease, namely hyperparathyroidism.

With the discovery of these facts came important metabolic studies indicating serious disturbances in calcium and phosphorus metabolism. And thus hyperparathyroidism came to be associated with increased serum calcium, decreased serum phosphorus and increased phosphatase activity. The diagnosis of hyperparathyroidism thus appeared to be a relatively simple matter. However, in actual practice this has not proved to be the case. Those interested in this subject since Mandl's[1] first operation for the removal of a parathyroid tumor are acquainted with the confusion and controversy that has attended the establishment of criteria for the diagnosis of this disease. Although hyperparathyroidism is now well established as a clinical entity there still remain, in the minds of many, uncertainties regarding its diagnosis.

From the standpoint of the roentgenologist the problem that presents itself is the recognition and proper interpretation of the bone lesions associated with hyperparathyroidism. In the beginning, the finding of single or multiple areas of osteitis fibrosa led to the roentgenologic diagnosis of this disease. In many cases, however, the diagnosis could not be substantiated either by chemical studies of the blood or, in some instances, by actual exploratory operations upon the neck. Thus there has appeared in the literature many case reports of conditions in which the roentgenological manifestations have simulated hyperparathyroidism but in which no abnormality of the parathyroid glands could be demonstrated. These conditions have been given a variety of names by the various authors reporting them. In this category is the condition recently described by Lichtenstein[2] under the name of "polyostotic fibrous dysplasia."

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In May, 1938, Lichtenstein reported a series of 8 cases presenting multiple bone lesions in which the histological picture and the clinical manifestations were sufficiently alike to constitute a distinct clinical entity. Since the bone lesions are always multiple (polyostotic) and are thought to be due to some abnormality in development during the fibrous tissue stage of bone formation (fibrous dysplasia) the descriptive name of polyostotic fibrous dysplasia has been given to the condition. Lichtenstein's attention was first directed to this condition by Dr. Henry L. Jaffe, director of the laboratories at the Hospital for Joint Diseases, New York City, who had noted certain constant histological features in a small group of bone specimens submitted to him for pathological study. The diagnosis of polyostotic fibrous dysplasia can be suspected from the clinical and roentgenological manifestations but confirmation is dependent upon the characteristic histological findings of a bone biopsy. This is a point of utmost importance and the 2 cases which form the basis of this report emphasize this fact.

CLINICAL MANIFESTATIONS

In the literature will be found a number of case reports under a variety of titles presenting features essentially the same as those found in polyostotic fibrous dysplasia. Lichtenstein believes that these are all one and the same disease. From these, as well as the few cases that have been reported under the name of polyostotic fibrous dysplasia, it is evident that the disease is primarily one of childhood but because of the protracted course the condition is not encountered medically until adolescence or adult life. Of Lichtenstein's 8 cases the youngest was nineteen and the oldest forty-seven. However, the average age of onset of symptoms was ten years. The condition occurs more frequently in females than in males. It is probably not at all uncommon since in a personal communication from Jaffe he states that he has already seen about 20 cases. Pain, limp and deformity of one lower extremity are the usual clinical manifestations. Pathologic fracture, especially of the femur, is quite common. The onset of symptoms is insidious, the pain and disability are slowly progressive, deformity usually becomes manifest at the height of the disease which is generally reached during adolescence or early adult life. The disease is apparently never fatal and evidently never cured; however, it becomes less active with increasing age of the patient.

ROENTGEN ASPECTS

The most striking feature of the disease is the bone changes as shown by roentgen examination. The lesions are multiple, being scattered but not generalized, and show a distinct tendency to be predominantly unilateral. The bones of the extremities are chiefly involved, especially the lower limbs, the femur and tibia being most frequently affected. However, no bone is apparently exempt as lesions have been reported in the skull, pelvis, ribs and the small bones of the hands and feet. Roentgenographically, the lesions usually present the rather typical appearance of osteitis fibrosa; that is, irregular areas of decreased density having a ground glass appearance. These areas are often interspersed with bony trabeculae producing a cystic appearance. This gives an erroneous idea of the lesion as histologically no cysts are found. With increase in size of the lesions there is a thinning of the cortex of the bone which eventually may become slightly expanded. Functional activity of the bones thus weakened by the disease process causes deformities to develop. This is particularly noted in the occurrence of coxa vara and bowing of the femur and tibia. The loss of bone substance and the thinning of the cortex predisposes to the occurrence of pathologic fractures which when healing occurs may also result in skeletal deformities. During the active stage of the disease, that is during childhood and young adult life, there is little tendency to reactive bone changes in the absence of fracture. In later life some attempt at bone regeneration may be noted. With increasing age of the patient the le-

sions show a tendency to retardation in development but never disappear.

BLOOD CHEMISTRY

The roentgenologic picture very closely resembles that seen in some cases of hyperthyroidism. The differential diagnosis depends largely upon the chemical findings in the blood. Whereas in hyperparathyroidism there is an increase in the serum calcium, a decrease in serum phosphorus and usually a marked increase in the serum phosphatase, in polyostotic fibrous dysplasia the serum calcium may be of a top normal value or even slightly elevated but never assumes the high values seen in hyperparathyroidism. Also, there is no significant change in the serum phosphorus. The phosphatase content of the blood is moderately increased, the highest values being found in cases showing the most activity. Furthermore, in hyperparathyroidism a study of the calcium metabolism shows an excessive excretion of calcium in the urine when the patient is placed upon a low calcium diet, so-called negative calcium balance. In polyostotic fibrous dysplasia, upon the same diet, the urinary excretion of calcium is normal. While the blood chemistry and calcium metabolism studies serve to differentiate the two conditions, the advisability of depending entirely upon these laboratory tests is challenged by a bona fide case of polyostotic fibrous dysplasia recently reported by Garlock[3] in which the serum calcium was slightly elevated and there was a marked negative calcium balance.

PATHOLOGIC FINDINGS

Certainly the roentgenologic appearance of the bone lesions are not pathognomonic of polyostotic fibrous dysplasia and since there is some doubt as to the specificity of the blood chemistry and calcium metabolic studies it would appear that a positive diagnosis is dependent upon the histological study of a bone biposy. At the time of the surgical removal of the bone for biopsy purposes there is noted a thinning of the cortex of the involved bone. The medullary cavity is filled with a grayish-white fibrous tissue, the consistency of which has been variously described as spongy, elastic or rubbery. On cutting through this material there is noted a gritty sensation due to the presence of newly formed spicules of bone. In addition, this abnormal tissue is solid, presenting no evidence of cyst formation. On microscopic study the fibrous tissue is found composed of spindle cells with oval, pale staining nuclei and indistinct cytoplasmic outline. It is this fibrous tissue that roentgenographically gives the lesions their ground glass appearance. Ths cystic appearance that is seen on the roentgenograms is due to the presence of trabeculae of primitive, poorly calcified new bone that traverses the fibrous tissue in an indefinite manner. It is emphasized that no cyst formation is present and this is one of the features that distinguishes this lesion from that found in hyperparathyroidism. The amount of new bone formation is dependent upon the vascularity of the fibrous tissue, which tends, however, to be relatively avascular. A variable number of small lymphocytes and mononuclear cells may be present in the fibrous stroma and small nests of giant cells resembling osteoclasts may be encountered. In addition, small islands of hyaline cartilage may be encountered which tend to become calcified and thus adds to the gritty nature of the tissue. The fibrous tissue completely fills the marrow cavity of the involved portion of the bone and by endosteal resorption causes a disappearance of the spongiosa and results in the characteristic thinning of the cortex. Further proliferation of the fibrous tissue may produce a slight expansion of the thinned cortex. In the uncomplicated lesion (absence of fracture) there is no evidence of periosteal new bone formation.

CASE REPORT*

H. M., a Polish female, aged twenty, was admitted to the Jefferson Medical College Hospital on November 13, 1937, complaining of pain in both hips, worse on the right side. She

* This case has been reported previously by Horwitz and Cantarow.[4]

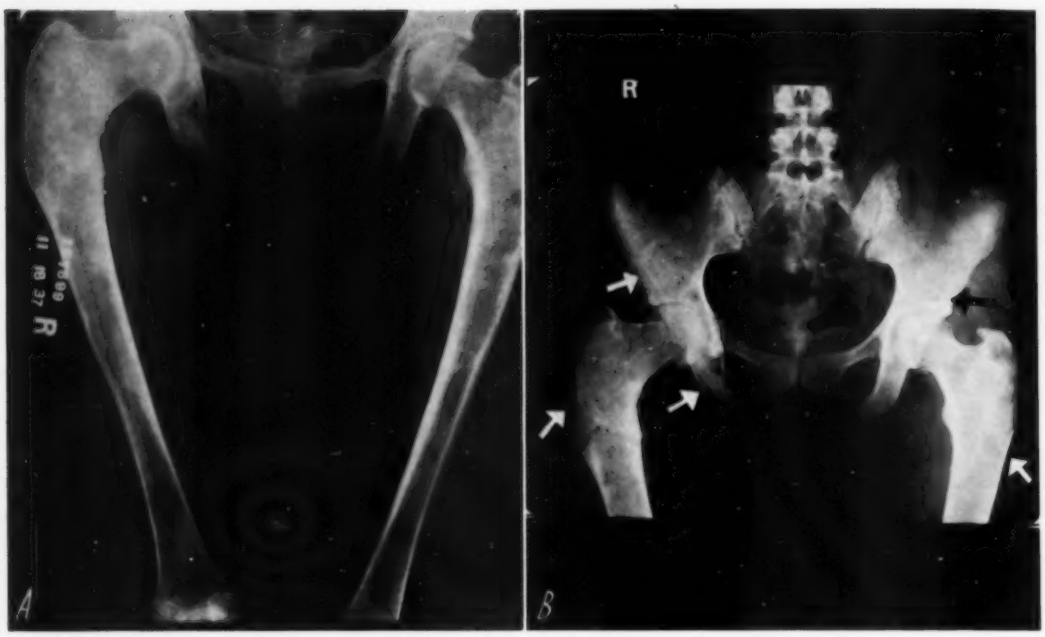

Fig. 1. Case H.M. Polyostotic fibrous dysplasia. *A*, showing deformity frequently encountered in this condition; outward bowing of femora and coxa vara. *B*, characteristic lesions of osteitis fibrosa with decreased density and ground glass appearance. Note thinning and expansion of cortex.

states that her illness began nine years before, at the age of eleven, when she fell while skating. Shortly after this she began to experience pain in her right hip which caused her to limp. This continued but nothing was done until about two years ago (1935) when a physician told her that the right leg was 2 inches shorter than the left. In September, 1936, she was operated upon at another hospital, an osteotomy being performed on the upper end of the right femur. Following convalescence she continued to limp and experienced pain on walking. This was a dull ache beginning in the hip and extending down the right leg.

On physical examination there was found a slight diffuse enlargement of the thyroid. There was an increased prominence of the upper third of the right thigh with an operative scar and tenderness on pressure over the greater trochanter of the femur. The physical examination was otherwise negative.

Roentgen examination showed deformity of the upper half of both femurs more marked on the right side. This deformity was due to an outward bowing of the bones and a moderate degree of coxa vara (Fig. 1, *A*). The entire shaft of both bones showed a radiolucency presenting a ground glass appearance. The lesions were traversed by rather coarse trabeculae presenting the appearance of multiple cyst formation. The cortex of the bone was considerably thinned and showed definite expansion in the upper half of both femurs (Fig. 1, *B*). There was some shortening of the right femur and evidence of a healed osteotomy below the lesser trochanter.

Similar lesions were found in the pelvis involving the ilium on both sides, the upper portion of the right acetabulum and the right ischium and pubis (Fig. 1, *B*). There was cortical thinning and a ground glass appearance throughout the right tibia and the left fibula. Examination of the skull, thorax, spine and the bones of both upper extremities presented no abnormalities. There was a large area of decreased density in the right os calcis (Fig. 2, *B*) with a fusiform expansion of the shafts of the right fourth and fifth metatarsal bones (Fig. 2, *A*). A diffuse mottling was noted in the right scaphoid and cuneiform bones and a broadening of the proximal phalanges of the right fourth and left second toe (Fig. 2, *A*). The roentgenological diagnosis was hyperparathyroidism.

The laboratory studies showed nothing significant in the blood counts or urinalyses. The urine showed no evidence of Bence-Jones pro-

tein. The serum calcium was 8.63 mg. per 100 cc., serum phosphorus 3.2 mg. per 100 cc. and phosphatase 8.5 Bodansky units.

A surgical consultant advised against search for a parathyroid tumor in the absence of abnormal blood chemistry. The patient was discharged on December 5, 1937.

The patient has been under constant observation up to the present time. She has been hospitalized on repeated occasions for varying periods of time and has been followed in the Out-Patient Department when not in the hospital. Her symptoms have been somewhat variable although pain in the lower extremities has been a more or less constant feature, showing some variation, however, in severity. She has at times complained of pain in the lumbar region of the back, both upper extremities and has had frequent attacks of headache.

She has been seen by numerous consultants. Several neurological examinations have failed to show any disease of the central nervous system. A psychiatrist believed she had a neurosis superimposed upon her physical ailment. The appearance of urinary tract symptoms led to a urological investigation which was negative. An ophthalmological study revealed nothing abnormal. She was followed constantly with much interest by the orthopedic consultants. The occurrence of frequent upper respiratory tract infections brought the patient to the attention of the otolaryngologist whose examinations revealed nothing of note.

Repeated roentgenological studies of all parts of the body have shown a slight progression of the lesions found at the time of the first examination. No new lesions have appeared.

Extensive laboratory studies have been carried out, most examinations being done repeatedly. Blood counts have revealed at times a slight anemia. Differential white counts have always been normal. Repeated urine examinations have been essentially negative with the exception of one period when there was evidence of a transient urinary tract infection. A lumbar puncture and examination of the spinal fluid gave negative results. Sugar tolerance was normal and the basal metabolic rate on two occasions was +15 and −17 per cent. Wassermann and Kahn reactions were negative. No Bence-Jones protein found in the urine. The cholesterol content of the plasma was 199 mg. per 100 cc. The blood sugar 76 mg. and the urea nitrogen 10.5 mg. per 100 cc. The urea clearance of the blood was 51 per cent of the average normal.

From the laboratory point of view interest, of course, centered in the investigation of the calcium and phosphorus metabolism and such tests were repeatedly performed. Serum calcium ranged between 8.63 and 11.2 mg. per 100 cc., serum inorganic phosphorus 2.1 and 5.2

Fig. 2. Case H.M. Polyostotic fibrous dysplasia. Characteristic lesions in both feet, indicated by arrows

Fig. 3. Case H.M. Polyostotic fibrous dysplasia. Microscopic appearance of biopsy specimen in different magnifications. *A*, ×100; *B*, ×250.

mg. per 100 cc., serum protein 5.94 to 7.84 gm. per 100 cc., and serum phosphatase, 2.7 to 11.2 Bodansky units. These studies were always within normal limits with the exception of an occasional top normal value for serum calcium and the phosphatase which was persistently elevated with the exception of one determination.

Urinary excretion of calcium and phosphorus for three day periods with a low calcium diet (0.111 gm. of calcium and 0.78 gm. of phosphorus daily) was as follows:

Date	Calcium mg.	Phosphorus mg.
May 30–June 2, 1937.....	348	884
June 24–27, 1938.....	172	2,720
Sept. 4–7, 1938.....	232	1,523

On June 20, 1938, the possibility of polyostotic fibrous dysplasia was suggested and a bone biopsy recommended. Subsequently a piece of bone was removed from just below the greater trochanter of the left femur. Grossly, no periosteal reaction was observed, the cortex was extremely thin, and the spongiosa was replaced by a gritty, whitish fibrous tissue which bled slightly. The histological report was as follows: "The tissue is composed of very cellular bone and fibrous tissue. There is evident bone absorption and bone regeneration. The connective tissue is quite cellular containing numerous areas of osteoid tissue and spicules of calcified bone as well as numerous blood vessels. No normal cellular marrow tissue is observed. There is a total lack of normal haversian system formations in the bone. In the cellular connective tissue stroma are numerous multinucleated cells. No evidence of necrosis or cyst formation is observed. Pathological diagnosis: osteitis fibrosa" (Fig. 3).

In spite of the laboratory studies which persistently excluded the possibility of a parathyroid tumor, an exploratory operation on the neck was done September 16, 1938. The thyroid gland was exposed without difficulty. No structure resembling parathyroid tissue was seen. A subtotal thyroidectomy was done. The thyroid tissue appeared normal and no parathyroid tissue was seen in the substance of the thyroid. Histopathological report: adenoma of the thyroid; hyperplastic thyroid tissue; no parathyroid tissue seen.

From the clinical, laboratory, roentgenological and histopathological studies the case was regarded as one of polyostotic fibrous dysplasia. Pathological sections of bone removed at biopsy were sent to Dr. Henry L. Jaffe who confirmed the diagnosis.

The treatment of the patient throughout has been on a purely symptomatic basis. The pain has been controlled for the most part by mild sedation and physiotherapy. Occasionally morphine has had to be resorted to and for this reason the advisability of a subarachnoid injection of alcohol was considered and recommended. She has had two such injections with only temporary relief of pain. Cordotomy has been considered but not performed.

The condition of the patient when last seen in July, 1940, was distinctly improved. She still had some pain in the right hip but none in the left. She complains considerably of her shoulders and back but no abnormalities can be demonstrated in these regions. A repetition of

the roentgen studies of the skeleton revealed no appreciable change in the osseous lesions.

Comment. This case of polyostotic fibrous dysplasia conforms in all essential features with those described by Lichtenstein. Roentgenologically the bone lesions resembled those seen in hyperparathyroidism and the two conditions could not be differentiated by the roentgen appearance. The lesions, however, were not predominantly unilateral as has been described for polyostotic fibrous dysplasia. The studies of the calcium and phosphorus metabolism were definitely not those of hyperparathyroidism but were essentially those found in polyostotic fibrous dysplasia in that the serum calcium tended at times to be top normal and the serum phosphatase was elevated. Calcium balance studies were normal. The clinical course has been characteristic and finally the histopathological study of a bone biopsy established the correct diagnosis.

The original purpose of presenting this case was to introduce the subject of polyostotic fibrous dysplasia to the roentgenological literature. However, a case report recently appeared by Moehlig and Schreiber.[5] When first planned it was thought that 2 cases of this condition would be available for presentation. The second case on further investigation, however, could not be established as one of polyostotic fibrous dysplasia. Nevertheless, because of its similarity and the diagnositic problem presented, it is included in this presentation.

CASE REPORT

J. A., white, male, aged twenty-five, was admitted to the Jefferson Medical College Hospital January 26, 1940. Chief complaint was pain in back and feet when standing or walking. The family history and past medical history were irrelevant.

About two and a half years ago, just after the patient had lost his job (by reason of bankruptcy of firm for which he worked), he began to have pains in his back, in both the thoracic and lumbar regions, and in both feet, especially the heels. He was treated by his family physician without avail. He was sent to the local hospital of another city to have his tonsils removed. Following this he began attending the Out-Patient Department of the same hospital and there he had treatment of various kinds such as injections of novocaine, lumbar taps, light treatments and various forms of physiotherapy, without benefit. He was readmitted to the hospital. After careful study the patient's condition was thought to be of muscular origin and a biopsy from a muscle of the back was taken. Histologically, however, this revealed nothing abnormal. He was put in a plaster cast (body cast) in which he remained for seven weeks. This afforded no relief and was therefore removed. The patient was then referred to the Jefferson Medical College Hospital for study.

At no time during the two and a half years of his trouble with his back and feet did he have any other symptoms except pain, until about two months ago when he developed "phlebitis" of his right leg. At that time his right leg was swollen, red, hot and tender. Shortly after this his left leg became involved and presented the same picture. At the present time these symptoms have entirely disappeared.

On physical examination the patient was found to be fairly well nourished and developed, and the examination was entirely negative. The tentative diagnosis on admission was "hypertrophic osteo-arthritis." Roentgen studies were requested of the osseous skeleton. Clinically the patient was regarded as neurotic and was about to be discharged from the hospital when the roentgen report revealed definite evidence of organic disease.

The roentgen examination of the osseous skeleton showed peculiar changes involving a large number of bones. These changes consisted primarily of a variable degree of demineralization of the bones, most marked in the small bones of the hand and feet (Fig. 4, *A* and *B*). There were similar changes involving the metaphyseal regions of the long bones of the upper and lower extremities (Fig. 5, *A* and *B*); the pelvis was similarly involved as well as the ribs. At least three of the ribs showed a dissolution of continuity near their vertebral attachments to the spine (Fig. 6). These constituted either pathological fractures or so-called pseudofractures. Several of the metatarsal bones of both feet showed a similar type of pseudofracture (Fig. 7). These, however, presented evidence of healing in the form of external bone callus. An early isolated lesion, evidently a precursor of a pseudofracture, was found in the

Fig. 4. Case J.A. This patient's condition was characterized by a generalized demineralization of most of the bones of the skeleton, most marked in the hands and feet. *B* shows an isolated lesion in the right ulna, very probably a precursor of a pseudofracture.

right ulna (Fig. 4, *B*). The skull was negative as were also the heart and lungs. Roentgenologically the appearance of the bones was thought to be that of osteomalacia. Several diagnostic possibilities were considered, such as hyperparathyroidism, metastasis from a neuroblastoma of the adrenal, atypical bone tuberculosis and sarcoid.

Fig. 5. Case J.A. The same generalized decalcification was found in the metaphyseal regions of all the long bones of the upper and lower extremities. *A*, femora; *B*, tibiae and fibulae.

An intravenous urogram was done and a complete roentgen study of the gastrointestinal tract with negative results.

In the laboratory studies, repeated blood counts and urinalyses were negative. The Wassermann and Kahn reactions were negative. No Bence-Jones protein was found in the urine. An electrocardiogram was negative and the basal metabolic rate was −3 per cent. The bilirubin was 0.2 mg., prothrombin 75 per cent of average normal, cholesterol 177 mg., serum calcium 8.98 and 9.38 per 100 cc., serum phosphorus 2.5 and 2.1 mg. per 100 cc., serum protein 7.25 and 8.49 gm., serum albumin 4.26 gm. and serum globulin 2.99 gm. The phosphatase was 5.1 and 6.6 Bodansky units. Urinary excretion of calcium and phosphorus for a three day period on a low calcium diet (0.111 gm. of calcium and 0.78 gm. of phosphorus daily) was as follows: urine calcium 350.3 mg. and urine inorganic phosphorus 451.4 mg., a normal calcium balance. Thus all studies were negative with the exception of a questionable slight elevation of the phosphatase. The sedimentation rate was negative. The blood pressure ranged between 90 to 114 systolic and 50 to 75 diastolic.

From these studies it was felt that hyperparathyroidism could be excluded and the possibility of polyostotic fibrous dysplasia was considered.

Fig. 6. Case J.A. In addition to the demineralization of the ribs, several showed resorption tracts, so-called pseudofractures, indicated by arrows.

Fig. 7. Case J.A. Pseudofractures were found involving two of the metatarsal bones. These, however, showed evidence of attempted healing by periosteal proliferation.

A sternal puncture was done and the marrow thus obtained was studied with the following conclusion: "There is a moderate hyperplasia of all bone marrow elements but particularly the erythropoietic tissue. The reason for this hyperplasia is obscure since there is no history of anemia at any time. It is possible that the cortical changes in the bone may be secondary to this hyperplasia in the marrow, but it is not possible to be sure of any such relationship on the basis of this examination."

A study of the marrow was also done from material removed from the inner end of the clavicle with the following report: "The cytological composition of the marrow in the clavicle differs very materially from that found in the sternum. There is significantly less erythropoietic tissue than observed in the sternal marrow. The puncture was made in a section of the clavicle shown by the roentgenogram to be surrounded by osteoporotic bony tissue. The significance of these findings is obscure and no interpretation may be placed on them at this time."

A bone biopsy was done, a portion of one of the involved metatarsal bones being removed. Histopathologically this was reported as fol-

lows: "The section consists of a small piece of bone. In some areas there is a slight necrosis of the bone and evidence of bone regeneration. There are rows of osteoblasts and a few osteoclasts. In other areas, there is a rather marked fibrosis. The lesion is definitely not tumor. It is, however, suggestive of one of the more chronic forms of inflammatory lesions of bone" (Fig. 8).

An abstract of the patient's history along with the roentgenograms and histological sections were sent to Dr. Henry L. Jaffe for his opinion. The following is taken directly from his reply:

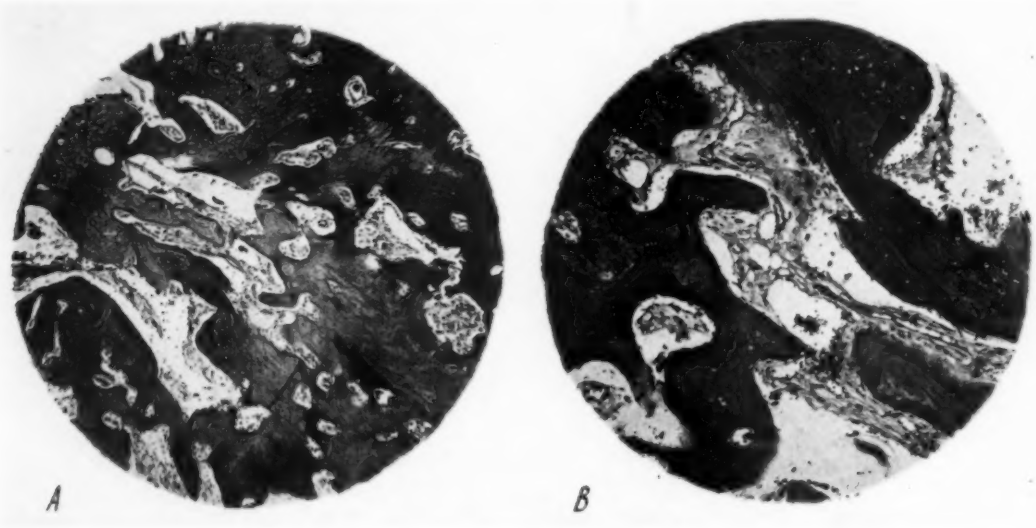

Fig. 8. Case J.A. Microscopic appearance of biopsy specimen in different magnifications. *A*, ×100; *B*, ×250. This may possibly be a case of multiple spontaneous idiopathic symmetrical fractures (Milkman).

You were right in feeling dubious about the correctness of the diagnosis. I do not think that this is an instance of the condition in question (polyostotic fibrous dysplasia). The x-ray films show a rather generalized porotification of the skeleton with numerous transverse resorption tracts. The tissue slides show periosteal new bone apposition. The newly apposed bone is not altogether normal histologically. It seems to be rather poorly ossified. No evidence of significant fibrosis or very active resorption is present.

As you note, the chemical findings are not consistent with a diagnosis of hyperparathyroidism. The histologic findings also seem to speak against such a diagnosis. What one is dealing with, therefore, is a very extensive osteoporosis in a male. If these findings had been noted in a female—particularly if she had given a history of repeated pregnancies—one would be tempted to diagnose the case as one of genuine osteomalacia (that is, calcium deficiency plus vitamin D deficiency rickets of adults), and the histologic findings would tend to support this diagnosis.

However, the case cannot be as simple as this. It would be interesting to know whether the subject has been suffering from chronic diarrhea, and whether the stools are bulky and foul-smelling in a way which would suggest idiopathic steatorrhea (non tropical sprue). The hyperplasia of the bone marrow, the histologic changes in the bone, and the somewhat low calcium value would harmonize with such a diagnosis. If the diagnosis of idiopathic steatorrhea is excluded, one would have to think of some endocrine disturbance other than hyperparathyroidism. Specifically, one would have to consider the possibility of pituitary basophilism, adrenal cortex tumor, and even a thymus tumor. If these possibilities are excluded, all that one could say would be that one was dealing with a case of osteoporosis difficult to classify, and would simply have to wait until new advances in medicine have brought more enlightenment.

Some of the conditions mentioned in Dr. Jaffe's letter, especially idiopathic steatorrhea, basophilism and adrenal cortex tumor, had been considered as diagnostic possibilities but there seemed not to be sufficient evidence in favor of any of these diagnoses. The condition is probably the same as the one described by Milkman[6,7] under the name of "Multiple spontaneous idiopathic symmetrical fractures." The two cases have many features in common.

A communication from the patient's physician under date of September 10, 1940, indicates that the patient is now disabled to the point of requiring the use of crutches. He has pain at the site from which the biopsy was taken, but otherwise feels quite well. He has increased in weight since his discharge from the hospital. Recent roentgenograms show a definite increase in the generalized decalcification of the osseous skeleton.

DISCUSSION

These cases serve to illustrate the diagnostic difficulty that besets the clinician when confronted with a condition in which some disturbance in the osseous system is the chief clinical manifestation. The clinical signs and symptoms are, as a rule, not very helpful from a diagnostic point of view. As in the second case here reported, the patient would have been dismissed with a diagnosis of a neurosis had not the roentgenogram revealed obvious bone lesions indicating some grave systemic disturbance. This directs our attention to the importance of the roentgen examination and the duty of the roentgenologist. He has the first opportunity to make the diagnosis and thus it becomes necessary that he acquaint himself with these osseous lesions and their differential diagnosis as far as our present knowledge will permit. We are only too well aware of the fact that too little is known regarding the entire subject of systemic osseous pathology. Much has been accomplished by the investigations of hyperparathyroidism. This is now a distinct entity that can be differentiated from other conditions presenting a similar clinical picture. Whether polyostotic fibrous dysplasia is also a clinical entity can only be established by further investigation. Certainly there is sufficient similarity in the cases that have been described under this title to warrant placing them in a separate group. It is a great help to the physician to be able to name and classify a case even though the condition is not fully understood.

Unlike hyperparathyroidism, the etiology of polyostotic fibrous dysplasia is not known. Likewise we have no knowledge regarding its treatment. Until these phases of the subject are better understood there is likely to remain some doubt regarding the specificity of the condition. Various theories have been proposed regarding the etiology. Lichtenstein regards the condition as a congenital anomaly of skeletal development resulting from a perverted activity of the specific bone-forming mesenchyme. The cause of the perversion of this specific embryonic tissue is, however, not known. Lichtenstein states that there is no histological evidence that the condition is either neoplastic or inflammatory in nature and even though it be congenital there is no recorded instance of hereditary transmission of the disease.

In 1937 Albright[8] and his associates reported a series of 5 cases under the title of "Syndrome characterized by osteitis fibrosa disseminata, areas of pigmentation and endocrine dysfunction, with precocious puberty in females." The characteristics of the syndrome are: (*a*) multiple bone lesions which have a marked tendency to be unilateral and which show osteitis fibrosa on histological examination; (*b*) brown non-elevated pigmented areas of the skin which tend to be on the same side as the bone lesions; (*c*) an endocrine dysfunction which in females is associated with precocious puberty. Apparently Lichtenstein considers these cases as examples of polyostotic fibrous dysplasia. Etiologically the syndrome described by Albright, *et al.* was thought possibly to be a manifestation of an underlying trophic neurologic disturbance or of an embryologic defect, as regards the occurrence of bone lesions and areas of skin pigmentation. The sex disturbances are obviously of endocrine origin which might be initiated by nervous influences. It is unlikely that the entire syndrome is on an endocrine basis. Thus again the congenital nature of the condition is suggested, and a possible endocrine factor proposed.

Moehlig and Schreiber in their recent case report place special emphasis upon the etiology of polyostotic fibrous dysplasia. They apparently accept Lichtenstein's

theory that the condition is due to a perverted development of the bone-forming mesenchyme. They suggest that this perversion is the result of a hereditary dyspituitarism. In their patient, a male aged sixteen, they state that a hereditary dispituitarism was present on the maternal side in the form of familial shortness of stature and premature loss of teeth. Hypopituitarism was present in the patient, being manifest by gynecomastia, absence of a beard and axillary hair, feminine distribution of pubic hair, and a puerile type of voice. They further advance the opinion that in polyostotic fibrous dysplasia the unilateral involvement of the skeleton is due to an unbalanced chromosomal aberration.

It is thus seen that the etiology of polyostotic fibrous dysplasia is still in the realm of theory. That the condition is congenital seems generally agreed upon and certainly there is strong evidence to suggest implication of the endocrine system.

Of more practical importance is the fact that this disease is so frequently mistaken for hyperparathyroidism, to the point that some of the cases have been operated upon for a parathyroid tumor in spite of the chemical evidence against this possibility, as in the case herein reported. From the standpoint of the roentgenological appearance of the lesions the error is a natural one as there is apparently no absolute differential roentgen diagnosis. Of considerable aid in the differentiation is the fact that the lesions of polyostotic fibrous dysplasia are either unilateral or predominantly so, although there are exceptions to this as exemplified by the case forming the basis of this paper. The fact that in one condition the bones contain cysts which are absent in the other is not very helpful, since, as pointed out by Albright, "it is almost impossible to differentiate by x-ray a bone cyst filled with fluid and an area of bone destruction filled with fibrous tissue." In polyostotic fibrous dysplasia the bone lesions are exclusively those of osteitis fibrosa without the generalized demineralization or rarefaction of most of the bones of the skeleton as seen in hyperparathyroidism. The tendency for the lesions to affect chiefly the femur and tibia and to manifest a localized rather than a generalized distribution is also characteristic of polyostotic fibrous dysplasia.

The diagnosis of polyostotic fibrous dysplasia would appear to rest upon four diagnostic criteria: (1) clinical aspects, the onset of symptoms during childhood, the development of pain, disability and deformity and the slow, protracted but progressive course of the disease; (2) the roentgenological manifestations, multiple bone lesions of osteitis fibrosa showing a predilection for the femur and tibia, with a tendency to be predominantly unilateral and an absence of decalcification of the uninvolved bones; (3) chemical studies, top normal or slightly elevated serum calcium, normal serum phosphorus, a normal calcium balance and a moderately elevated phosphatase activity, and (4) bone biopsy showing a thinning of the cortex, a replacement of the marrow and spongiosa by dense, gritty, rubbery fibrous tissue interspersed with poorly calcified bone spicules and an absence of cyst formation. Certainly the most conclusive evidence is the histopathological study of a bone lesion and the diagnosis should not be accepted until substantiated by a bone biopsy. Furthermore, there is no justification for an exploratory operation for a parathyroid tumor until the four diagnostic features above mentioned have been thoroughly investigated.

SUMMARY

Attention is called to the roentgenological significance of osteitis fibrosa and the necessity of attempting a differentiation of the various conditions in which this pathological change is encountered. Of recent introduction to medical science is the condition known as polyostotic fibrous dysplasia in which osteitis fibrosa is the basic osseous manifestation. The clinical and roentgenological aspects, the laboratory findings and the histopathological features of the condition are described. An illustrative case of polyostotic fibrous dysplasia is reported

along with another case showing some similarity but in which the diagnosis could not be confirmed by microscopic examination of a bone specimen.

Theories regarding the etiology of polyostotic fibrous dysplasia are discussed. The resemblance to hyperparathyroidism and the differential diagnosis of the two conditions are considered. Four criteria for the diagnosis of polyostotic fibrous dysplasia are established and the importance of a bone biopsy is emphasized.

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DISCUSSION

Dr. Fuller Albright, Boston. I think Dr. Kornblum is to be congratulated on a very interesting case presentation of a very interesting case of a very interesting disease. I shall speak more of this disease this afternoon.

I should like to say a word about the terminology. Last night I read again von Recklinghausen's monograph written in 1891, in which he discusses a whole scrapbasket of bone conditions. I think von Recklinghausen mistook his own disease as it were. Cases v, vi and vii in that monograph are usually considered as examples of von Recklinghausen's disease of bone which is synonymous with osteitis fibrosa cystica generalisata and which is now known to be associated with hyperparathyroidism. From the description, I now believe that Cases v and vi did not have so-called von Recklinghausen's disease but did have polyostotic fibrous dysplasia.

Now, is "polyostotic fibrous dysplasia" a good term? Almost everyone who has written on this strange malady has coined his own name. I think Dr. Kornblum is to be congratulated on being about the first person who has not added a new name. I don't like "polyostotic fibrous dysplasia." As a matter of fact, I don't like any of the names including the one I used myself. The trouble with polyostotic fibrous dysplasia is that it is a descriptive name but does not describe. Thus, both Paget's disease and von Recklinghausen's disease of bone are polyostotic and fibrous and dysplasias.

Unfortunately, the disease is still in the descriptive stage and one has to resort to a descriptive name. I chose the name "osteitis fibrosa disseminata" to differentiate the condition from osteitis fibrosa generalisata and osteitis fibrosa localisata. In so doing I tried to call attention to the fact that the bone disease is not generalized nor localized but disseminated about the body. I admit the condition is probably not an osteitis but that is true of most of the bone diseases in which we use the term "osteitis."

The descriptive name for the disease, furthermore, should include some reference to the areas of pigmentation and to the precocious puberty of females. These aspects of the disease are just as important as the bone changes. You will recall Lena Medina of Peru, the girl who gave birth to a child at the age of five. In answer to an inquiry, Dr. Gerardo Lozada of Pisco, Peru, her attending physican, informed me that she had both the brown spots and bone changes together with the precocity. To diagnose her condition as polyostotic fibrous dysplasia would seem to me to be inadequate.

I should like to say a word about the differential diagnosis. Dr. Kornblum has intimated that the histopathological examination is the most certain way of making this diagnosis. In my experience with quite a considerable number of cases now I have found the roentgen ap-

pearance of the skeleton quite distinguishing and the histopathological appearance of the bone quite confusing. I recently had occasion to write to Dr. Jaffe in New York on this subject and asked him how he made the differential diagnosis between osteitis fibrosa generalisata and this condition and whether or not he could always do it. He replied that he thought he could make the differential diagnosis if he had sufficient material. The most distinguishing feature on microscopic examination is the islands of cartilage which one finds in this condition and which one seldom sees in the bone disease of hyperparathyroidism. In one case which I have studied it was very clear that the islands of cartilage represented epiphyseal cartilage which had not been transformed into bone.

In the roentgen examination of the skeleton there are three features which distinguish this condition from osteitis fibrosa generalisata. In the first place there are areas of increased density and overgrowth of bone as well as decreased density. Secondly, the condition is not generalized and one should be able to find parts of the skeleton which are perfectly normal. Dr. Kornblum has emphasized this point. In the third place the disease practically never involves the epiphyses.

Finally I would like to say a word about the disease described by Milkman. I have seen the roentgenograms of only one case. These were sent to me by Dr. Frederick Bost and Dr. Robert S. Stone of the University of California. I have brought lantern slides of the roentgenograms. It is an extraordinary condition. The biopsy material in their case suggests osteomalacia which was true of Milkman's original case. The slides, as you will see, show the same sort of thing as in Dr. Kornblum's case. Note the same extraordinary pseudofracture of the hips, the same extraordinary lesion of the pelvis. It is an entirely un-understandable disease as far as I am concerned. I should love to have a chance to study one of these cases. If it really is osteomalacia the condition should be easy to establish. The blood chemistry in Milkman's case, and in this case was consistent with osteomalacia but I can't conceive of its being that from the course of the disease and other things about it.

DR. S. B. WOLBACH, Boston. Dr. Sosman always likes to put me "on the spot," and he has done it just now because this is a subject about which I know nothing except what I have learned from the roentgenologist, and this is because the pathologist doesn't get a chance to study such materials. They should be studied in sequence from early life on.

The one remark that Dr. Albright made about the occurrence of hyaline cartilage in the lesions of this disease impresses me very much because the case presented reminds me of a child at the Children's Hospital many years ago, who was studied, I believe, from the age of seven or eight to about twenty years of age. There was a biopsy from the femur at an early age, lesions consisted of hyaline cartilage, cartilage so immature that I thought we were dealing with a tumor—an opinion which was corroborated by my elders at that time.

The roentgenological appearances seemed to be quite similar to those under discussion. After puberty, I think at the age of fifteen, because of great deformity due to bowing, an operation was done and the findings described by Dr. Kornblum were present. The material formerly consisting of cartilage, with some reparative changes on the part of the bone, now was dense, rubbery, connective tissue.

I can only conclude by saying that this paper emphasizes the opportunities and perhaps the obligations of roentgenologists in their association with pathologists and clinicians. You have taught us a great deal and you have forced us to learn a lot.

In this particular type of disease, I believe we can make no progress until we can follow the sequences from the very early periods.

DR. MERRILL C. SOSMAN, Boston. I would like to ask Dr. Kornblum if he has given roentgen therapy to any of these areas of abnormal bone growth, and if so was there any demonstrable effect on the progress of the condition.

DR. KORNBLUM (closing). It is indeed very gratifying to have such an eminent authority as Dr. Albright discuss this paper. I have mentioned that Lichtenstein called this a distinct clinical entity. I was not entirely convinced of this in spite of the fact that I have talked with Dr. Albright and he also believes that it is an entity.

I did not have an opportunity to say anything about the etiology and treatment. We know very little about either of these, and until these phases of the subject have been settled, I think it will be difficult to be convinced of the specificity of this condition.

Regarding the terminology, I quite agree with Dr. Albright that the name "polyostotic fibrous dysplasia" is not very good. This disease has been called by a different name by everyone who has described it, except for a few cases reported since Lichtenstein's paper

It reminds me of the term osteitis fibrosa commonly used by many people, as a clinical entity. Osteitis fibrosa occurs in a large variety of conditions and is not an entity, but merely one pathological change, which may mean anything.

Personally I would much prefer to call this condition Albright's syndrome until we know a little more about the condition. I am grateful for the various points to which Dr. Albright has directed our attention. Dr. Albright also mentioned the fact, which I did not have time to discuss, that the roentgenologist has the first opportunity to make the diagnosis in these rather rare and obscure bone lesions, and therefore it is the duty of every one of us to learn just as much about these conditions as possible. We must admit, of course, that what we know today is very little and much that we do know about it we owe to Dr. Albright

I have said that the condition is rare. In a recent communication from Dr. Jaffe, I am told that he already since 1938 has collected 20 of these cases, and I have been impressed by the number of members attending this meeting who have come to me and believe they also have cases which fall into this category; so we are dealing with a condition probably not as rare as we are led to believe.

In regard to Dr. Sosman's remarks, in our case I do not think we tried roentgen therapy. I am not sure about that, however.

LEPTOMENINGEAL CYSTS

FROM A ROENTGENOLOGICAL VIEWPOINT

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IN ORDER that we may clearly understand what a leptomeningeal cyst is, we must first briefly consider the cranial meninges and their interrelationships. The outermost layer of the three cerebral envelopes is the dura mater which is a tough fibrous membrane sometimes called the pachymeninx, and is composed of an inner and outer layer. This membrane is in close relationship with the inner table of the skull, in fact it substitutes for the periosteum. In childhood this association is even closer than it is in adults, and for this reason extradural hemorrhage is infrequent in children. The pachymeninx is in intimate contact with the bone around the margins of the larger foramina and over the projecting bony irregularities of the floors of the various cranial fossae, also along the sutures where it may be found at times to be continuous with the external periosteum. It is of interest to note in passing that the meningeal vessels are included in the outer layer of the dura mater. This accounts for the formation of vessel channels on the surface of the inner table of the calvarium, which are so readily seen in good roentgenograms of the skull. Between the two dural layers we find several important structures among which might be mentioned the dural venous sinuses, the "cavum Mecklii" in which is found the gasserian ganglion, the lacunae venosae laterales which are sometimes in relationship with pacchionian bodies, and the saccus endolymphaticus, the dilated end of the endolymphatic duct.

Portions of the dura mater form many projections and reflexions among which might be mentioned the complete investment of the optic nerve as compared to the short tube-like covering of the other nerves as they leave the cranium, which is known as the dural sheath. By prolongations of the inner dural layer there are formed such structures as the falx cerebri, the falx cerebelli, the tentorium cerebelli, and the diaphragma sellae. Within the dura mater we not infrequently find relatively benign deposits of calcium; in fact in about 5 per cent of an average run of roentgenograms of the skull, sufficient calcium will be present to cast a shadow and so localize the dura for purposes of diagnostic orientation. The under surface of the dura mater is covered with endothelium and although no definite evidence of lymphatics has ever been seen in this structure, some have described what were thought to be epidural lymph spaces. It is the endothelial under surface of the dura that constitutes the outer boundary of the subdural space into which hemorrhage often occurs, and this space is usually more or less involved in the presence of leptomeningeal cysts which we are about to consider.

The arachnoid which underlies the dura mater is a thin membrane composed of connective tissue, and together with the pia mater is often known as the leptomeninx. The arachnoid does not follow the convolutions of the brain as does the pia mater, hence except at the apices of the convolutions where the pia and arachnoid are almost inseparable, there exists a considerable subarachnoid space. This space is normally filled with fluid and is traversed by innumerable arachnoidal trabeculae, and where the space is not extensive these trabeculae are so numerous as to form a fine reticulum. It is within the subarachnoid space that we find the system of cisterns known collectively as the cisternae subarachnoidales, and each division is named according to the name of the structure with which it is in most intimate contact.

The subarachnoid fluid is continually being augmented chiefly by way of the foram-

ina in the fourth ventricle, and being excreted along the nerve sheaths and into the venous sinuses through the medium of the pacchionian bodies. The arachnoid membrane is apparently avascular and therefore cannot react to irritations as other tissues do, but it may undergo a thickening and cellular infiltration, so that the term arachnoiditis can be used to designate irritations even though there is no inflammatory reaction that is entirely comparable to inflammatory reactions seen elsewhere.

The pia mater lies in direct contact with the brain tissue itself and carries the blood vessels for the nutrition of the cortex. The pia mater is very thin and can be followed into the sulci and fissures, but most anatomists state that definite pial membrane cannot be demonstrated as being present within the small shallow fissures of the cerebellum. Over the base this vascular membrane is not heavy enough to contain entirely the larger arteries which although invested with more or less pial tissue are practically within the subarachnoid space and therefore occasionally can be visualized in good encephalograms.

With this brief review of the chief points of interest of the meninges, it will be easier to understand the formation of meningeal cysts and their effects on adjacent tissues. Cysts of the leptomeninx have been recognized for some time. Quain described such a cyst in 1855, and in 1907 Krause called attention to such a condition, but he described it as "circumscribed cystic arachnoiditis." Others have called it "hydrocephalus externus circumscripta," "circumscribed serous meningitis" and by other descriptive terms.

If we bear in mind the general architectonics of the subarachnoid space, it will be easily understandable how cysts can form from any abnormal blockage of the normal interchange of cerebral fluid between the innumerable potential divisions of this space formed by the trabeculae. Injury is a common cause. The more severe the injury, particularly if it is in a young person, the more likely it is that adhesions will form and cysts develop. Such cysts, when of traumatic origin, are very apt to be limited by a fibrous hyperplasia of the trabeculae, but the arachnoid may be relatively normal. It is probable that leptomeningeal cysts may develop as a sequela to meningitis. This is borne out by the occasional finding of an apparently inflammatory reaction surrounding the cysts. Spurling feels that in the presence of a blood clot enough irritation of the

Fig. 1. A bone defect. The result of an old fracture. Surrounded by irregular areas of bone atrophy caused by underlying leptomeningeal cysts.

leptomeninges may be set up to cause cyst formation. There is reason to believe that leptomeningeal cysts may result from localized areas of adhesions between the pia and the arachnoid which may also involve the cerebral cortex. Such a combination may be found following a meningo-encephalitis. Cysts of this type may give rise to the clinical symptoms of a solid cortical tumor and so have been termed by some writers pseudotumors.

Cysts of the meninges, of whatever origin, may involve the subarachnoid space within the cortical or deep sulci, and so give rise to convulsive attacks of the jacksonian

type or even paresis of the opposite side. Again, such cysts may be found in any of the subarachnoid cisterns including the cysterna chiasmatis, and so give rise to eye symptoms not unlike those of solid tumors of this region. If the cystic formation involves others of the system of basal cisterns there may be produced a definite elevation of intracranial pressure. Meningeal cysts have been reported as being found in con-

Fig. 2. Irregular areas of bone thickening and some atrophy in the immediate neighborhood of an old healed fracture. This bone change was associated with leptomeningeal cysts.

junction with acoustic neurinomas, whether because of or in spite of the presence of the tumor is difficult to state. However, as it is clearly evident that any interference with the function of the arachnoid villi will tend to interfere with the normal flow of cerebral fluid, and as such interference may well be caused locally by any tumefaction, localized subarachnoid cysts can be formed, and if extensive enough some degree of hydrocephalus will result.

Now that we have discussed the why and wherefore of leptomeningeal cysts, we can proceed to the consideration of the changes produced in the roentgenogram which we might be able to recognize as being produced by such lesions. First of all, it must be clearly evident that the cysts, per se, will not cast a shadow which we could see in the usual stereoscopic examination of the skull. In fact it is only those lesions occurring over the cortex that can be expected to produce changes in the skull which could be recognized and considered as reasonably characteristic.

The deep seated lesion, unless it produced some degree of hydrocephalus, might well produce no change recognizable in the film. If hydrocephalus were present we could recognize the usual changes resulting from an elevation of intracranial pressure, which have been described in detail in previous articles on cranial pathology and will not be reiterated here. Encephalography might permit of outlining a cyst in a basal cistern provided the gas was not entirely blocked from entering, but failure to visualize a basal cistern by an encephalogram can be caused by so many factors that the fact in itself is of no great diagnostic significance. And even if a mass were outlined by the gas it would not be pathognomonic. In fact, unless the cyst in some way might be partly filled with gas, and this would be unlikely, we would have no definite clue as to the nature of the lesion. Of course we are not considering here porencephaly or cystic tumors.

The leptomeningeal cysts which occur over the cerebral hemispheres will often be found grouped around, and in the near vicinity of areas of old trauma, and as a rule the more severe the trauma was originally, the more apt are cysts to form. It usually takes from two to four years for the cysts to be well enough developed and large enough to produce any recognizable changes in the overlying bones of the calvarium. The typical case will show areas of varying degree of bone atrophy, having rather irregular, somewhat scalloped or rounded margins surrounding or close to an old fracture which may itself show some bone absorption and enlargement of the original defect. The bone atrophy caused by these cysts is

simple atrophy and nothing more, as there is no invasion of the bone. However, irregular areas of increased density may at times be noted due to the healing of a fracture or atypical bone reaction to the underlying cyst. This will usually distinguish the lesion from the bone change caused by an epidermoidoma which tends to destroy the bone. An early epidermoidoma of the meninges might produce an overlying bone atrophy which would be very difficult to distinguish from that produced by a leptomeningeal cyst. In fact, the symptoms and history might be similar for the two types of lesions and to make a definite preoperative differential diagnosis may at times be very difficult. However, if we have a film which shows quite definitely the presence of an old fracture, and surrounding the fracture we see areas of halisteresis as previously described, we can be reasonably certain that cysts are present.

A fairly characteristic clinical picture of a case with leptomeningeal cysts would be as follows: A boy, about eighteen years of age, gives a history of severe head trauma at the age of sixteen months at which time he was unconscious and bled from the nose and ears. There also was said to be a depression of the skull. Two years prior to his present hospitalization he suddenly lost consciousness while walking on the street. Since that episode there have been several similar attacks. He does not bite his tongue nor is he incontinent. This represents a fairly typical history and as the roentgen examination of the skull revealed changes strongly suggesting cyst formation about an old fracture defect, the patient was operated upon and the cysts were found.

Another somewhat similar sequence of events is portrayed in the following brief history of a boy of nine years of age. He suffered a bad fall at the age of three years, which resulted in a fracture of the right side of the skull with the formation of a large hematoma. Since then headaches have been a constant symptom, and three years after the accident he began to have convulsions with loss of consciousness. It was noted that during these attacks his eyes would turn to the left. The roentgen examination of this patient made the diagnosis sufficiently certain so that an operation was performed. Meningeal cysts were found, together with adhesions over the right parietal lobe.

SUMMARY

The formation, characteristics and roentgen diagnosis of leptomeningeal cysts have been discussed. The roentgen diagnosis is usually possible only when the cysts occur under the calvarium. The evidence consists essentially of areas of bone atrophy and occasionally adjacent areas of increased density, usually associated with an old fracture line.*

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* The illustrations are from the teaching collection of the Neurological Institute of New York.

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REVERSIBLE BRONCHIECTASIS

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IT WAS not long after the clinical study of bronchiectasis was aided considerably by bronchography that the first observations on reversibility of bronchiectasis were published.

In this paper we follow the almost general use of the term bronchiectasis as designating any abnormal bronchial dilatation. Some authors, however, would reserve this term for permanent dilatation only. With this restricted definition of the term there is no point in speaking of the "reversibility of irreversible changes," this being merely a play on words. Other authors denominate reversible bronchial dilatations as pseudobronchiectasis. This distinction not only is arbitrary and illogical but prevents a better understanding of the pathology of the disease. In every disease we investigate the early stages, trying to recognize stages where irreparable damage to the anatomical structures has not yet taken place. It therefore seems to me a mistake to segregate under the new term pseudobronchiectasis those reversible dilatations which possibly may represent an early stage of bronchiectasis, thus excluding them from the field of discussion.

Ochsner[13] reported in 1929 that he had found bronchial dilatation in about 90 per cent of a group of students with chronic coughs. Following treatment in 4 of these cases a second bronchogram unexpectedly demonstrated that the bronchial dilatation had disappeared. The transient character of bronchiectasis has become familiar particularly to pediatricians. Altmann and Engel[1] in 1933 stated that bronchiectasis in children appears almost regularly as a sequel to acute respiratory inflammations. These simple cylindrical dilatations were unquestionably reversible, the change back to normal caliber usually occurring quite rapidly. Christopherson[5] considered that the dilatations of the large bronchi, so frequently found in patients with chronic coughs, are reversible. Jennings[9] reports with illustrative bronchograms a single careful observation of the appearance and reversal of bronchiectasis in a case of bronchitis complicated by atelectasis of a lower lobe, giving what I consider to be a scholarly interpretation of the pathological events observed. Lander and Davidson[11] noted with bronchography the appearance of bronchiectasis in a child after aspiration of a pea. After removal of the foreign body the bronchiectasis disappeared completely. Wilson[14] observed a triangular shadow in the right cardiophrenic angle of a child, and with lipiodol he was able to demonstrate stenosis of the lower lobe bronchus with bronchiectasis in the lobe. Bronchoscopy confirmed the findings and biopsy showed tuberculous granulation tissue at the site of the stenosis. After six months in a sanatorium the bronchial obstruction was essentially relieved, the triangular shadow had disappeared and the bronchogram showed normal filling of the bronchial tree.

As the reversibility of bronchiectasis is still far from being generally known, and as the certain establishment of this is important for our knowledge of the pathogenesis of this disease, and finally since this knowledge furnishes the basis for the conservative treatment and prophylaxis of bronchiectasis, it was thought advisable to publish the following observation from the Massachusetts General Hospital.

CASE 1 (U546). A school girl, aged fourteen, was first admitted to the hospital on November 14, 1934, because of chronic cough. She was entirely well until fourteen months prior to admission when she developed sore throats. A tonsillectomy was done and thereafter she developed a dry cough, a feeling of fatigue, weakness, loss of appetite, and loss of weight. Five months before admission she began to cough up small amounts of foul tasting sputum. On July

5, 1934, a film (taken outside) revealed a minimal opacity in the left lung base. On July 29 she had three hemoptyses and on September 6 another roentgenogram showed a spread of the pathological condition in the left base. During the two months before admission the cough was more severe, hemoptyses occurred and she was feeling worse. There was no evidence of foreign body or tuberculosis. Physical examination showed slight dullness in the left base with bronchial breathing and râles, persisting after cough. The lungs were otherwise negative. There were occasional slight rises of temperature up to 100°F. The sputum was not foul or layering and it contained a few gram-positive cocci, but no fibers. There were apical foci at the teeth, and sinusitis. The roentgenological examination showed consolidation in the left lower lobe suggestive of bronchiectasis. The lipiodol study revealed cylindric bronchiectasis in the left lower lobe, in the lingula of the left upper lobe, and in the right middle lobe (Fig. 1). There was no appreciable evidence of collapse of the involved lobes. Lobectomy of the left lower lobe was planned and the patient was advised to enter a sanatorium for three months in order to improve her general health before operation. After entry to the sanatorium on December 27, 1934, she had an occasional slight elevation of temperature and raised about 3 ounces of thick, non-foul sputum daily. Under postural drainage she improved rapidly, the cough gradually subsiding, so that she eventually coughed but two or three times a day and raised practically no sputum. She gained in weight and strength.

Fig. 1. Cylindric bronchiectasis in the left lower lobe and the lingula of the left upper lobe.

Fig. 2. Same patient, seven months later. The bronchi of the left lower lobe show normal width and their branches are better filled by lipiodol.

On readmission to the hospital on June 20, 1935, she felt perfectly well. Physical examination was negative. The roentgenogram showed only slight haziness in the left lower lung field. Bronchography revealed that the bronchiectasis in the right middle lobe and in the lingula had not changed. The bronchial tree of the left lower lobe, however, appeared to be normal. The width and outline of the bronchial branches were not abnormal and there was better filling of the smaller branches (Fig. 2). On account of

Fig. 3. Same patient, sixteen months after Figure 2. Marked bronchiectasis of the left lower lobe.

the subjective and objective improvement the patient was discharged.

During the following winter the patient had several colds which confined her to bed. The cough and amount of sputum slowly increased to 3 tablespoonfuls daily. Sometimes there were inspiratory wheezes and râles over the left chest. In July, 1936, she had an ethmoid operation.

On her third admission to the hospital in October, 1936, lipiodol study revealed bronchiectasis of the left lower lobe, the lingula bronchus and the middle lobe, similar to that found on the first examination two years ago (Fig. 3). There was no appreciable collapse of the lower lobe. Bronchoscopy confirmed the findings of bronchiectasis in the left lower lobe and on November 28, 1936, a left lower lobectomy was performed by Dr. Churchill. At operation many adhesions to the diaphragm were found, but the rest of the pleura was free. The left lower lobe and the lingula were resected.

Pathological Report (Dr. Tracy Mallory). The base of the left lower lobe measures 10×7×9 cm. and its length 14 cm. There was also submitted the lingula of the upper lobe which measures 3×2×6 cm. The surface of the lung is smooth and presents a mottled grayish-pink appearance. On palpation it is doughy, slightly nodular and non-crepitant. The resected surface shows a grayish-pink parenchyma with the bronchial lumina measuring up to 4 mm. and their walls 1 mm. There is no evidence of peribronchial thickening. On pressure a slight amount of sero-muco-sanguineous material exudes. On section at the base of the lung the parenchyma is grayish-pink with the distal portions of the bronchi and the bronchioles showing moderate dilatation with several small abscesses at the extreme periphery which measure up to 0.3×0.6×0.5 cm. The mucosal surface of the bronchi is grayish-white, moist and smooth except for multiple transverse folds and occasional small evaginations which measure up to 1 mm. in diameter and less than 1 mm. in depth. The walls of the bronchi and bronchioles appear normal, measuring under 1 mm. and there is no peribronchial thickening. Diagnosis: Bronchiectasis; chronic pneumonitis. The bronchi are thin walled and dilated.

DISCUSSION

This patient was carefully observed between her fourteenth and sixteenth years during which time the onset and development of bronchiectasis were closely followed. The diseased part of the lung was ultimately examined pathologically following lobectomy. At the age of thirteen this patient first complained of fatigue, weakness, and weight loss following a tonsillectomy. Infectious operative material apparently had been aspirated resulting in a blockage and infection of the parenchyma of the dependent portions of the lung. After a few months the foul tasting sputum indicated putrid bronchitis. There probably existed small bronchial dilatations even at that time, and shortly afterwards roentgenograms showed consolidation in the left lung base. Three hemoptyses at this time made the presence of bronchiectasis very probable. A year after the tonsillectomy lipiodol showed cylindrical bronchiectasis in the left lower lobe, the lingula of the left upper lobe, and the middle lobe. There was

no notable collapse of the left lower lobe. Then during a stay of several months in a sanatorium, there was a rapid change in the picture. The sputum—hitherto 3 ounces daily, thick and occasionally foul—entirely disappeared, along with the cough, for the most part. Hand in hand with this went the disappearance of all the subjective and objective signs of the illness. Roentgenograms nine months after the original ones showed no definite consolidation of the left base. The bronchogram showed no change in the bronchiectasis of the middle lobe and lingula, but the bronchial tree of the left lower lobe appeared normal. The better filling of the small branches in the lower lobe was particularly noteworthy. This showed unequivocally that the obstruction of the peripheral bronchi had disappeared and that the aeration of the lobe had improved.

Later, however, the condition grew worse and a lipiodol filling again showed very extensive cylindrical dilatation of the bronchi in the left lower lobe with no filling of the small bronchial twigs—the typical picture of the "leafless tree." After lobectomy the lingula was found to be contracted, but the lower lobe was not appreciably shrunken. Pathological study showed bronchial dilatation corresponding to what was seen on the roentgenogram. There was no thickening of the mucous membrane, the bronchial walls were thin, and there was no peribronchial thickening. In the parenchyma of the lobe there was a chronic pneumonitis, i.e., some inflammation with atelectasis.

Atelectasis appearing with bronchostenosis or associated with inflammatory bronchial or pulmonary processes plays a decisive rôle in the formation of bronchiectasis. This has been generally recognized in the last ten years. There is still much that is not clear, however, concerning the effect and the interaction of inflammation, atelectasis, and bronchiectasis.

In treatises of pathology, the genesis of bronchiectasis, aside from more or less outspoken emphasis on congenital formations, is still ascribed to intrinsic and extrinsic factors. The pressure of stagnant secretion on the wall and the internal pressure of the air in breathing and coughing are considered intrinsic factors. Simple considerations show that these earlier conceptions are physically untenable, as was recently shown very clearly by Andrus.[2] Destructive changes in the bronchial wall with consequent weakening are further considered as causes of bronchial dilatation. These assumptions depend upon old observations in cases with severe ulcerations and other lesions of the bronchial wall. Most pathologists today assume that these are later changes in long-standing cases. Early bronchiectasis may show no gross changes in the walls. Neurogenic atony of the bronchial walls and congenital weakness also have been introduced as hypothetical causes. As an extrinsic factor, the fibrous contraction of the peribronchial tissue has been known for a century. Corrigan[6] described in his "Pulmonary Cirrhosis" a picture which we now recognize exactly as chronic collapse, but the old pathologist did not realize that pulmonary fibrosis with marked contraction is usually the final stage of atelectatic-inflammatory processes. In this regard it is interesting that the first historical description of bronchiectasis by Laennec[10] (1819) describes atelectasis of the interbronchial parenchyma.*

The mechanism of fibrous tissue contraction has been recognized as one of the causative factors in bronchial distention. Emphasis should here be placed upon the concept "tissue contraction," but not upon the word "fibrous." We have recognized that tissue contraction may occur in the absence of fibrosis and such tissue contraction due to atelectatic collapse is easily capable of dilating the bronchi. To emphasize this seems to be relevant, for even Anspach[3] whose fine studies have so eminently ad-

* "The intermediate substance of the lung is flabby, void of air, evidently compressed and, in short, resembling in every respect, the same substance when compressed toward the spine by an effusion of serous or purulent fluid into the pleural cavity." Laennec knew about compression atelectasis, but the mechanism of obstructive atelectasis had not yet been conceived at that time.

vanced our knowledge of the genesis of bronchiectasis, places the onset of bronchial dilatation—if I understand him correctly—simultaneous with the appearance of fibrosis.

What, now, are the circumstances of collapse and how does it dilate the bronchi? Besides its vital respiratory function the lung parenchyma also has a very simple mechanical or static-dynamic task. The plastic lung tissue protects the bronchi against the respiratory tugging of the thorax, just as loose connective tissue protects nerves and vessels where they are exposed to moving and bending in other parts of the body. If, during the inspiratory expansion of the thorax, the lungs are correspondingly stretched, the greater part of this pull and increase in volume is taken up by the parenchyma. A rhythmic respiratory dilatation of the bronchi, however, is seen by bronchoscopy and roentgenoscopy. In this connection complex reflex nervous phenomena have been suspected. In recent studies Ellis[7] found another explanation:

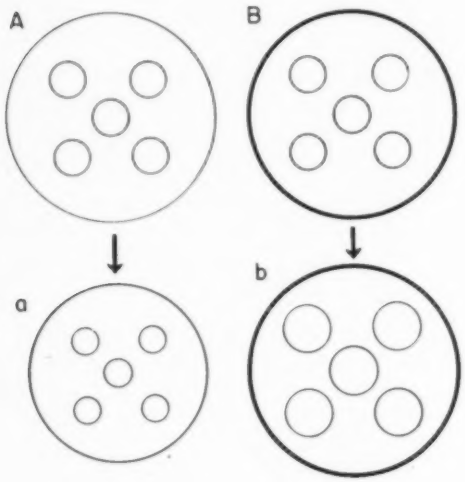

Fig. 4. Diagrammatic representation of an experiment illustrating the varying influence of atelectatic collapse on bronchi. *A* and *B* represent two sheets of dough with punched out holes. Allowed to dry, sheet *A* contracts concentrically and the holes in it become smaller (*a*). Prevented from shrinking by a rigid frame, sheet *B* retracts with consequent increase of the size of the holes (*b*).

The rhythmic changes in the caliber of the bronchi synchronous with respiratory movements are produced passively by the respiratory thoracic movements. Under normal conditions the bronchi can resist this moderate stretching force because of the anatomical structure of their walls. This pull, however, is quite considerably increased in atelectatic collapse of the lung. The great forces developed in atelectatic collapse are seen every day in patients showing displacement of the mediastinum, the diaphragms, and the ribs. The elastic distention or the tendency to recoil of the lung is usually measured by means of the intrapleural pressure. Thus we find pressures of -20 to -30 cm. water, and occasionally even -45 cm. in atelectatic collapse, contrasting with normal figures of about -3 to -6 cm. in inspiration and expiration respectively. Without going into detail, we can say that in such cases the tension in the lung is of an order of magnitude perhaps ten times the normal. When this tension works upon the bronchial wall then it is easily understood how the bronchi are dilated, because these anatomical structures cannot stand a force which goes far beyond physiological limits.

To this simple concept the objection is often raised that bronchial dilatation does not ensue in every case of atelectasis. This apparent contradiction is cleared by the following consideration. If atelectasis is able to proceed to the extent of maximal collapse no excessive stretching of the bronchi of the atelectatic area results and no dilatation occurs. This occurs when the atelectatic portions are small and movable and when the neighboring lobes, the heart, and the diaphragm are able to furnish adequate spatial adjustment. If, however, the affected area is too large or is incapable of complete collapse because of intrapulmonary or pleural rigidity, and if the neighboring structures are not sufficiently adjustable, there result disseminated foci of atelectasis in small areas between the bronchi which then become distended by contraction of the atelectatic areas. In real-

ity we meet all conceivable stages between these two extremes.

Years ago I used to illustrate these dynamics by the following simple experiment (Fig. 4). Holes of equal size were punched in two similar round sheets of dough. One sheet was fixed in a round frame, and both were then set out to dry. The free sheet contracted concentrically and the holes in it became smaller. The sheet which could not contract in total size, being exposed to the same drying and contracting tendency, developed enlargement of the holes with occasional irregular tears. The accompanying diagrams of this experiment illustrate grossly but very convincingly the relationship of collapse and bronchiectasis.

It should be further noted that inflammatory processes in the bronchi and lung, and general and local disturbances of ventilation, especially those caused by bronchostenosis, lead to atelectasis in varying degree. If we interpret the relationship between atelectasis and bronchiectasis in the manner depicted above, it is readily understood that dilatation of bronchi can occur shortly after the onset of collapse. Boyd[4] observed definite grape-like dilatations ten days after aspiration of a foreign body in a child with no previous illness. In another case a triangular shadow of atelectasis had developed four days after aspiration of a foreign body, and in ten days the bronchial dilatation was very definite.

From coordinating all our present knowledge on the subject it is understood that bronchiectasis may be reversed. When atelectasis clears up with release of the excessive traction, and with restoration of the cushion effect of the parenchyma, the bronchi will return to their normal size as long as no irreparable damage has been done to the walls. This will, in general, be the case when atelectasis has existed for only a short time and no serious inflammatory changes have taken place. We still lack sufficient experience in respect to the time when this reversal is still really possible. The conception here presented of the mechanism of atelectasis in the formation of bronchiectasis agrees with Jennings,[9] Andrus,[2] and others, and explains easily the events in the reversal of bronchial dilatation. The observation that such reversals really occur, however, is a decisive support for this concept of the pathogenesis of bronchiectasis.

To return again to our case report, the first roentgenogram revealed bronchiectasis in the left lower lobe, the lingula of the left upper lobe, and the right middle lobe. In the lower lobe, under the immediate strong ventilatory influence of the respiratory movements of the diaphragm, the atelectasis apparently cleared up early, permitting the bronchi to return to normal. The lingula and middle lobe, however, which are poorly ventilated lung regions inherently, remained in a state of collapse and bronchiectasis during the whole period of observation. But even in the lower lobe there might have been lasting damage of slighter degree, such as an interstitial fibrosis, limiting its ventilatory capacity, thus predisposing toward a relapse.

Is it possible to read from roentgenograms the reversibility of bronchiectasis? Our experience is too limited to permit a final answer. I doubt whether this will be possible in all cases. The case here presented, together with 2 incompletely observed cases, appears to give us a clue to this problem. In well developed cylindrical or fusiform bronchiectasis we see the lipiodol shadows rather sharp and smoothly bordered, the bronchi ending in saccular dilatations. In our first illustration and in the 2 other cases mentioned we see the lower lobe bronchi unquestionably cylindrically dilated, but the smooth rounding is lacking. Many branches, filled only at their beginnings, appear as short stumps. This is not the familiar picture of the "leafless tree" of bronchiectasis. It looks more as though a storm had broken off all the smaller twigs of the tree, the irregular stumps being left on the branches. The lipiodol shadows end in a peculiar abrupt manner, as though some secretion were blocking the distal parts of the bronchi.

The usual saccular expansions at the ends of the dilated bronchi are also absent. At present we wish only to call attention to these signs—we still have insufficient experience to evaluate their diagnostic importance and reliability.

SUMMARY AND CONCLUSIONS

In the most recent edition of Norris and Landis' "Diseases of the Chest," Leopold[12] introduces the chapter on bronchiectasis with the following statement: "The use of bronchoscopy and bronchography as diagnostic procedures in the examination of the bronchial tree has revolutionized the former clinical conceptions of bronchiectasis." The reversibility of bronchiectasis in the early stages is now an established fact, which is easily derived from the pathogenesis of bronchiectasis. Adherence to traditional concepts and neologisms such as pseudobronchiectasis considerably hinders the recognition of this fact. The problem is no longer to decide whether or not bronchial dilatations are reversible, but rather to recognize these early reversible cases and provide them with suitable antiatelectatic and respiratory gymnastic treatment in order as far as possible to avoid the well known later severe damage.

(1) A case is reported in which the development of the full clinical picture of bronchiectasis after tonsillectomy was followed by studies with lipiodol. This bronchiectasis cleared up for the most part under conservative treatment along with reversal of all the other clinical findings.

(2) When the bronchiectasis returned in a more severe form a lobectomy was done. Only moderate inflammatory changes were found in the parenchyma of the resected lower lobe, the bronchi being dilated but their walls thin and their mucosa delicate.

(3) The rôle of atelectasis in the formation of bronchiectasis is discussed and the events in the course of reversal are inferred.

(4) An attempt to predict the possible reversibility of bronchial dilatations roentgenologically is made.

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SPONTANEOUS RENAL AND PERIRENAL EMPHYSEMA

REPORT OF A CASE IN A DIABETIC FROM *ESCHERICHIA COLI* INFECTION*

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SPONTANEOUS generation of gas in the urinary tract is very uncommon. Attention is usually attracted to the condition by an accompanying pneumaturia. Duménil and Guiard (1883) were the first to point out that, in a diabetic, fermentation can occur within the bladder with resulting pneumaturia.

Kelly and MacCallum, in 1898, published a comprehensive review of the reported cases of pneumaturia including both the rare primary spontaneous and the more common secondary cases due to a fistula between the urinary tract and a gas containing organ. They cite but 3 cases and add 1 of their own in which gas was found in the renal and perirenal areas.

In 1934, Mulsow and one of us reviewed the subject of primary pneumaturia and reported 1 case, the first instance in which the roentgen examination indicated the condition. We were able to find but 16 references to the subject since 1900.

Since 1934, Nogueira,[4] Riley and Bragdon,[6] and Olsson[5] have each reported a case in which spontaneous gas was revealed by roentgen examination within the urinary tract. The present case is unusual in that the patient did not have pneumaturia, but developed gas within the renal and perirenal tissues.

CASE REPORT

A woman, aged fifty-two, entered the hospital on May 20, 1939, complaining of incontinence and vaginal bleeding (menopausal). The patient knew that she had diabetes for the past nine years. No attempt at control was made until one year ago when she developed a carbuncle on the neck. At this time she was hospitalized, placed on a diet, and 20 units of insulin three times a day. She has continued to take insulin, but says her urine always contains sugar.

One month ago, she began to have frequency and incontinence of urine. Small amounts of urine were voided from ten to twenty times a day and from three to twenty times a night. She could never pass a large quantity at one time.

Bimanual examination showed the bladder to be distended to the umbilicus. Obstruction was apparently due to an egg-sized Gartner's duct cyst or abscess found on the anterior vaginal wall. Upon catheterization, 2,100 cc. of urine was removed and an indwelling catheter left in the bladder.

The patient was found to be a severe diabetic with a blood sugar of 433 mg. per 100 cc. on admission. The diabetes was very difficult to control and the patient was given insulin, units 50–30–35–25 daily. In spite of this she passed from 26 to 80 grams of glucose in the urine when receiving a diet containing 250 grams of potential glucose.

On May 25, 1939, the patient developed a urinary tract infection with a fever of 102° F. and a white blood cell count of 20,000. The urine contained a large amount of albumin, was loaded with pus, and was grossly bloody.

On June 2, 1939, the patient was placed on sulfanilamide therapy, with a temporary drop in temperature. Soon the temperature again became elevated and the patient continued to grow worse for the next three weeks. On June 6, 1939, the patient had a chill followed by fever of 104° F. She became constantly nauseated and vomited frequently. The blood urea nitrogen was 37.9 mg. per 100 cc. and the blood creatinine 3.9 mg. per 100 cc. There was tenderness over both kidney regions.

On June 20, 1939, a film (Fig. 1) of the urinary tract plainly showed small bubbles of gas within the parenchyma of both kidneys. The gas was distributed radially within the kidney, but none could be seen within the kidney pelves or beyond the capsules.

On June 21, 1939, another film was made (Fig. 2). At this time throughout both kidneys there was extensive gas formation which was

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FIG. 1. Roentgenogram of the kidneys shows small bubbles of gas distributed radially within the kidney parenchyma.

still arranged in a radial manner as though within the interstitial tissue between the tubules. No gas could be seen within the kidney pelves. In addition, the perirenal tissues were extensively infiltrated with gas outlining the kidneys and adrenals on both sides in a manner comparable to the best perirenal air insufflations.

Coincidentally the patient became rapidly worse and was taken to the operating room. A small right lumbar incision was made, and the region of the right kidney exposed. There were a great many blebs present and bubbles of gas oozed out as the fatty capsule and true capsule of the kidney were opened. No odor of the gas could be detected.

Immediately after the drainage of the right perirenal space the patient went into shock and drainage of the left side was therefore not attempted. She died shortly afterwards in spite of supportive therapy. No necropsy was obtained.

Cultures of the blood and urine taken before death and cultures obtained from the right kidney region at the time of operation, all gave growths of *Escherichia coli*.

DISCUSSION

The reported cases of primary pneumaturia show three factors occurring with more than coincidental frequency. All were present in this case. These are diabetes mellitus, colon bacillus infection and lower urinary tract obstruction.

Cases are reported, however, occurring in non-diabetics in the absence of obstruction and from other organisms including yeast.

FIG. 2. Roentgenogram taken twenty-four hours after Figure 1. There is now extensive renal and perirenal emphysema outlining the kidneys and adrenals. No gas can be seen within the kidney pelves.

We believe that in this case the renal and perirenal emphysema was produced by the fermentation of glucose in the tissues from *Escherichia coli* which was cultured from the blood, urine and perirenal tissues.

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Vol. 46, No. 2

ROENTGENOLOGICAL CONSIDERATION OF INFLUENZAL PNEUMONITIS*

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THE quite regularly recurring, more or less extensive epidemics of influenzal pneumonia offer in certain phases differential problems which cannot always be answered correctly by the clinician or roentgenologist.

These difficulties are naturally encountered only in some forms of pulmonary involvement, depending on the pathological process predominant in each individual case. Almost all authors interested in this question recognize the anomalous character and variety of the lesions that occur with influenzal pneumonia.

PATHOLOGY

Winternitz and his coworkers regard any classification of such cases of pneumonia as unsatisfactory, but they divide their cases into the following groups: (1) an acute diffuse fulminating type of penumonia; (2) pneumonia with necrosis, and (3) pneumonia with organization.

The varied character of pneumonia following influenza is due to the occurrence of the following types of consolidation in numerous combinations:

Lobular Consolidation. This type of consolidation often implicates a large part of the substance of the lung (pseudolobar). In persons who die within a few days after the onset of pneumonia the consolidated lung tissue is flaccid, red and edematous (the acute diffuse type of Winternitz) but in other instances the lobular consolidation is firmer and gray.

Peribronchiolar Consolidation. Peribronchiolar consolidation is limited to the alveoli and alveolar ducts immediately about bronchioles. Small nodules of consolidation are widely scattered in the substance of the lung (the miliary bronchopneumonia of English writers). The lesion is the earliest stage of what MacCallum has designated interstitial pneumonia, but distinctive changes in interstitial tissue occur only when the disease pursues a chronic course.

Peribronchial Consolidation. A zone of alveoli encircling small bronchi is affected in this type of consolidation and suggests that the agent producing the lesion has penetrated the wall of the bronchus and entered the surrounding lung tissue (Opie, Blake, Small and Rivers).

Unresolved or organizing bronchopneumonia is associated with organization of the pneumonia exudate and may occur in consolidated lung tissue in any of the foregoing conditions, so that new fibrous tissue may be formed about bronchi and blood vessels, in interalveolar walls and in interlobular septa. The lesion is invariably accompanied by purulent bronchitis and usually by bronchiectases. The lungs are distended and do not collapse evenly when cut. Particularly characteristic are indurated foci of peribronchiolar pneumonia, which being firm and sharply defined as the result of organization of the exudate, may have the appearance of tubercles (miliary bronchopneumonia).

Marchand distinguishes the following anatomical forms of influenzal pneumonia:

1. "Minute acinous foci" is the designation given by Hübschman to miliary bronchopneumonic foci originating in the bronchi. These foci are grayish-red or yellowish except in the center, which is yellow. The yellow spot corresponds to a suppurating bronchus. The yellowish hue of the focus is due to fatty degeneration of the exudate. The alveoli are filled with leukocytes, proceding from the exudate in the bronchioles.

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The alveoli contain only a small amount of fibrin. Hübschman thinks these foci are characteristic of influenza.

2. In multiple confluent lobular pneumonia, the foci are confluent and larger and are brownish with a tendency to bleed. This form is the most frequent in influenza.

3. Suppurative bronchopneumonia is characterized by multiple necrotic and suppurative foci, varying from the size of a hemp seed to that of a pea, and formed of purulent bronchioles.

4. Large suppurative foci are sometimes wedge-shaped, sometimes jagged.

5. In lobar pneumonia there is a special tendency to suppuration.

Besides these forms, there is also the indurative, desquamative pneumonia of carnifying inflammation of the lung. This may be primary, it may occur in the early stage of the disease or later, developing secondary to a catarrhal form. Pulmonary lesions may be present in various forms in the same patient. Association of these lesions with those in other parts of the respiratory system results in a variegated picture, characteristic of influenza.

Summing up, it must be admitted that a form of pulmonary inflammation specific for influenza does not exist, for all the forms described may appear in other conditions as well.

ROENTGENOLOGICAL ASPECT

The polymorphous roentgenological appearance of the lungs affected by influenzal pneumonia is responsible for the great difficulties which confront the roentgenologist in differentiating this condition from other diseases, and especially from pulmonary tuberculosis. It is then very difficult to decide whether an old pulmonary tuberculosis has been reactivated by an influenzal pneumonia. The fact that early pulmonary tuberculosis may present the picture of an influenzal pneumonia is well known. We should only call attention to the "early infiltration" which has been so frequently mistaken for an influenzal pneumonia. The danger of confusing a pneumonitis with pulmonary tuberculosis must be also kept in mind.

The localization of the shadows offers only general, but no definite differential characteristics. Nor is the nature of the shadow (homogeneous, discrete or nodular appearance of the shadow) of decisive value. The clinical picture, and above all, observation of the whole course of the disease will frequently permit a correct diagnosis; however, in rather localized forms of pneumonias, it may not be characteristic. The most important and significant roentgenological indicator of pneumonia due to influenza in such cases is the rapid changeability of the original shadow.

We had the opportunity to observe a series of cases of influenzal pneumonia which were of particular interest because of their clinical and roentgenological aspect.

Clinically some of the cases, which will be reported in this paper, presented a conspicuous absence of a history of an acute onset, or symptoms indicating pathology of the respiratory organ. On the contrary, the signs of pulmonary involvement were negligible.

The complaints resembled those of tuberculous patients. They complained of general weakness, increasing with work, moderate elevation of temperature, not exceeding 101°F., loss of appetite, and considerable loss of weight. There was occasionally dry cough, and night sweating, but no chest pain. Sputum examination—where a specimen could be obtained—did not reveal presence of tubercle bacilli. On physical examination there was some dullness, coarse breathing and occasional râles.

In other cases, patients developed acute pulmonary symptoms (cough, hemoptysis and high fever), following a prolonged general malaise.

The roentgenograms of those patients showed a pulmonary infiltration, which varied in individual cases, as far as its structural characteristics, extent and localization were concerned. On the whole,

the infiltration had a tendency to localize in the upper lung fields, in the subclavicular region. Roentgenograms of the chest presented shadows of homogeneous density, with somewhat ill defined borders, near the lobar margin of the upper lobe or a diffuse, soft mottling, or marked peribronchial thickening with poorly defined contours, extending into the periphery. The greatest density of these shadows was noted near the hilum.

In some of these cases a mistaken diagnosis of pulmonary tuberculosis was made, based on the roentgenological findings.

And in fact they did resemble those cases of pulmonary tuberculosis which, especially in German literature, has been classified as "early infiltration," which, when not treated, has a tendency to involve the parenchyma progressively by a bronchogenic spread and to form cavities.

Because of this course of an "early infiltration" it seemed to us important to determine the pathology in our cases as exactly as possible, in order to avoid the manifold consequences of submitting a patient to collapse therapy, which is the therapy of choice in "early infiltration."

Being unable to determine the true nature of the pathology in every case, we resorted to serial roentgenograms, which permit an exact study of the type of lesion encountered in individual cases, and also its progress, which alone is of decisive importance in considering the treatment which should be instituted.

A thorough clinical and roentgenological consideration of pulmonary changes observed over a reasonable length of time should leave no excuse for difficulty in differentiating between early tuberculosis and influenzal pneumonitis.

CASE REPORTS

Case I. The patient, a physician, was sent to the roentgen department for examination of his chest because of the following complaints of several weeks' duration: fatigue, slight elevation of temperature, occasional dry cough, and some loss of appetite and weight.

A roentgenogram of the chest showed a fibrous infiltration of the right upper lung field extending from the upper hilum into the periphery, without distinctly sharp borders (Fig. 1).

Repeated sputum examinations failed to reveal tubercle bacilli. Complete rest was recommended and further observation of films taken at frequent intervals was deemed necessary.

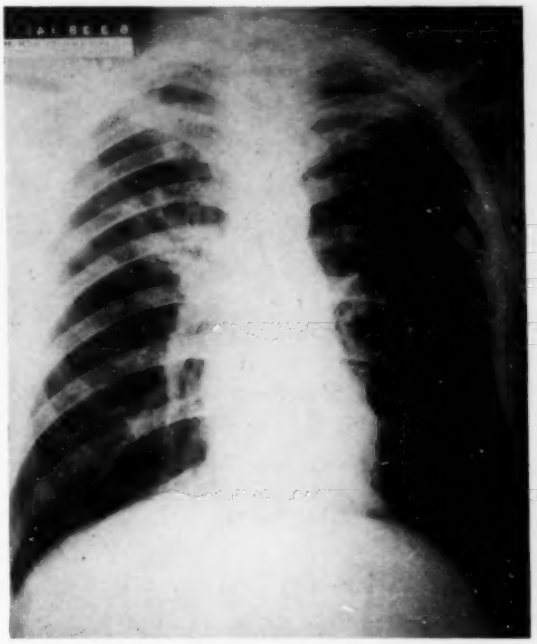

Fig. 1. Case I. Peribronchial infiltration of the right upper lobe, resembling pulmonary tuberculosis.

In the course of these observations a definite decrease in the size of the infiltration was noted, and six weeks later there was a complete restitutio ad integrum of the involved parenchyma (Fig. 2).

Subjective symptoms of the patient subsided and he has been able to resume his work.

Case II. Patient took sick suddenly, with an initial chill, elevation of temperature to 103°F., and sore throat. He was confined to bed for one week, after which a roentgenogram of his chest was made. There was at that time a mottling and peribronchial thickening of the right upper lung field, extending from the hilum into the subclavicular region and toward the periphery. The remaining parenchyma was clear (Fig. 3). On the basis of these findings, it was necessary to consider an early pulmonary tuberculosis, even though the clinical history suggested an

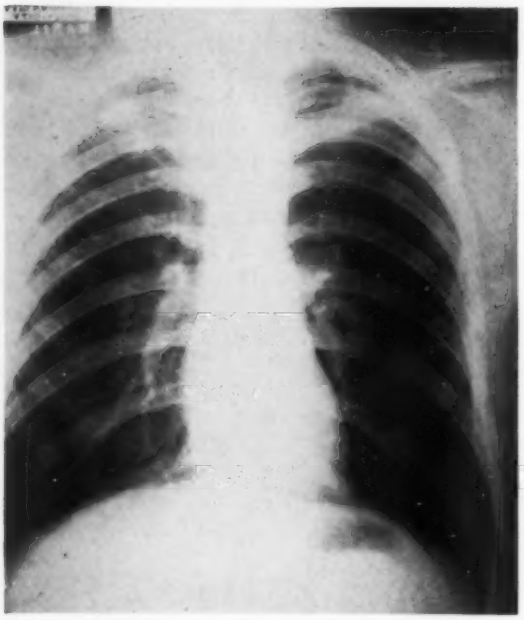

Fig. 2. Case 1. Complete resolution of the previous infiltration one month later.

acute inflammatory process. Repeated roentgenographic examinations of the chest showed a complete resolution within three weeks (Fig. 4).

It is well known that an early tuberculosis very frequently presents clinical symptoms and a clinical course resembling influenza. The acute symptoms in early infiltration are caused by bronchogenic aspiration, which extends to the lobar margin of the affected lung. They were designated by Sabourin as "embolie bronchique"—which explains their infraclavicular localization.

Only the physical signs found in patients with early infiltration are different from those encountered in influenza. In the acute stage there is no dullness on percussion and no râles can be heard. In the stage of remission, crepitation and fine constant moist

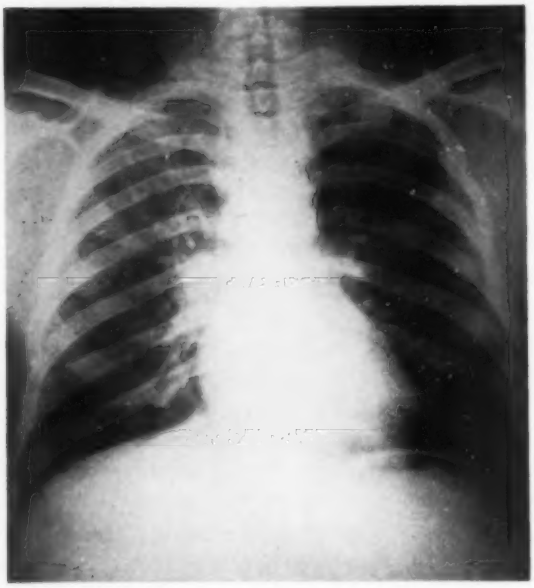

Fig. 3. Case II. Peribronchial infiltration of the right upper lobe.

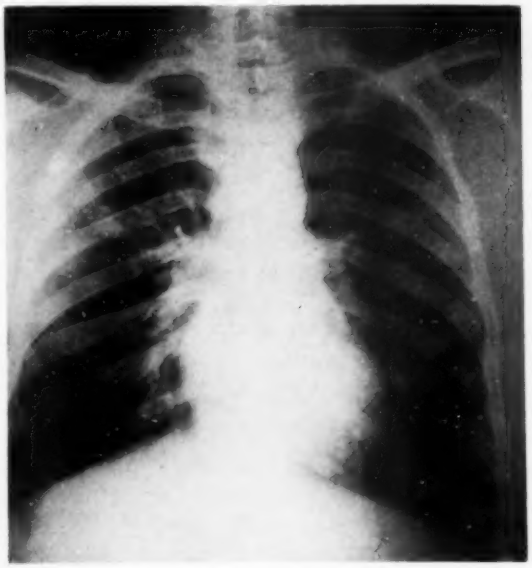

Fig. 4. Case II. Complete resolution of the previous infiltration three weeks later.

râles are present, which may in a relatively short time become coarse, suggesting the presence of a cavity.

Corresponding with clinical findings, roentgenograms in these cases show a progression of the initial lesion, and a cavity whose size varies in individual cases. Influenza shows a quite rapid restitution after remission of clinical symptoms.

Case III. Patient complained for last few weeks prior to the roentgen examination of weakness, moderate fever, cough, and some chest pain. His appetite was impaired and he lost some weight. He did not raise any sputum.

Roentgenographic examination of the chest showed a marked mottling and peribronchial thickening of the right upper and middle lobe, suggesting a resolving pneumonia (Fig. 5). Because of the history of rather prolonged illness, it was deemed necessary to rule out tuberculosis. Further observation and repeated roentgenographic examination showed a complete resolution of the original pulmonary infiltration.

Case iv. Patient was admitted to the hospital, with complaints of cough, moderate elevation of temperature —99.8°F., slight pain in the chest, and general malaise of two weeks' duration.

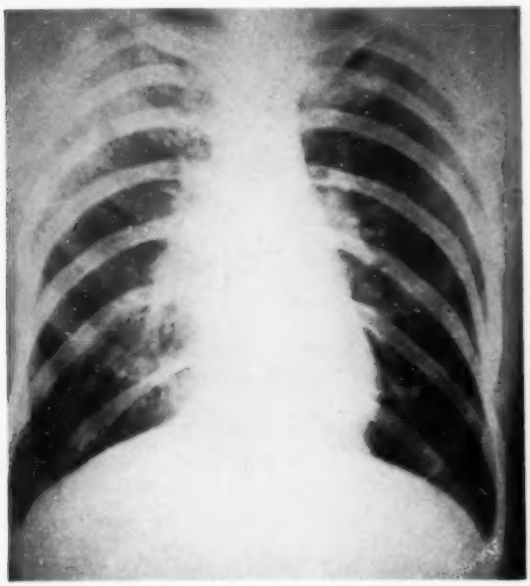

Fig. 5. Case iii. Diffuse peribronchial infiltration involving the right upper lobe including the apex.

On physical examination there was dullness in the right apex and subapical region and also posteriorly near the spine. There was tubular breathing and numerous râles. Leukocyte count was 20,000 with 86 per cent polymorphonuclears.

Roentgenographic examination of the chest showed a triangular homogeneous shadow in the right upper lung field, with its base at the lateral chest wall, and lower margin corresponding with the margin of the interlobar fissure between the upper and middle lobe. There was another shadow extending into the periphery from a markedly enlarged right hilum. The outer

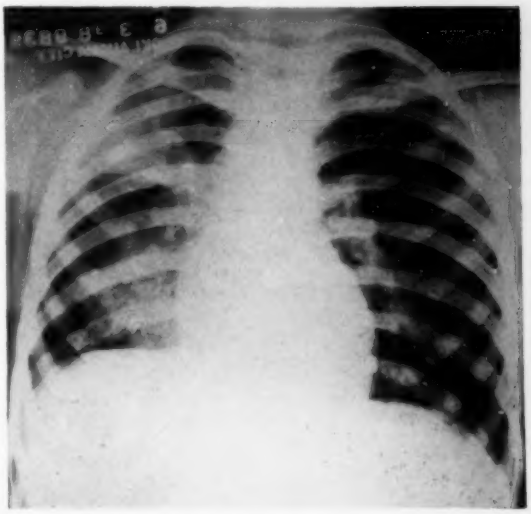

Fig. 6. Case iv. Consolidation of the base of the right upper lobe and perihilar infiltration of the right lung.

contour of this shadow was fairly well demarcated (Fig. 6).

In this case the roentgenological impression was that of a pneumonia involving more than one lobe, and it would be expected that an acute process should produce more definite subjective symptoms. In view of the discrepancy between

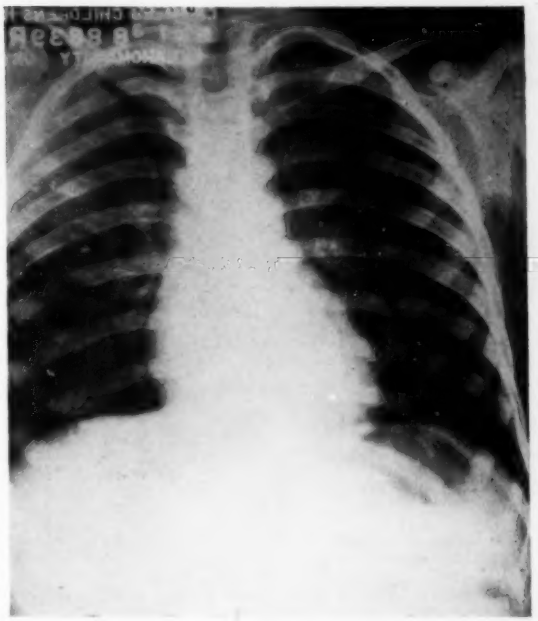

Fig. 7. Case iv. Complete resolution eight days after the original examination.

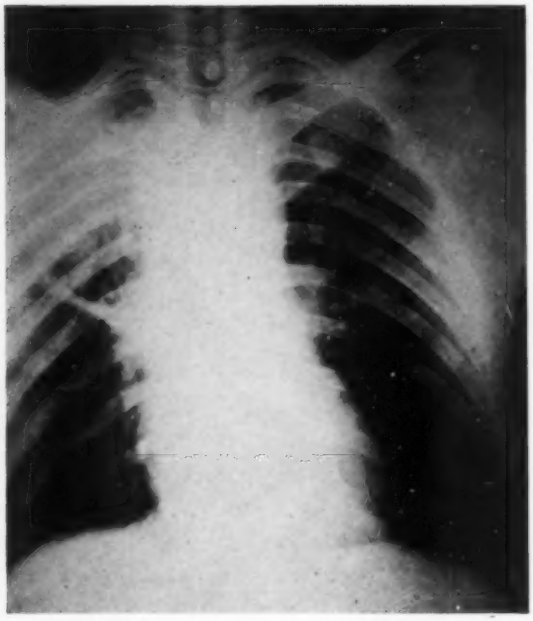

Fig. 8. Case v. Consolidation of the right upper lobe defined by the interlobar fissure.

the pathological changes and the patient's appearance, tuberculosis had also to be taken into consideration. Further observation was recommended. A film taken eight days later showed a complete restitutio ad integrum (Fig. 7).

Case v. Patient complained of cough, general malaise, slight fever. Three weeks prior to admission to the University Hospital, he had a chill and elevation of temperature to 102°F. He raised a moderate amount of seropurulent sputum. On physical examination there were dullness and râles in right upper lobe.

A roentgenogram of the chest showed a fairly homogeneous infiltration of the upper lung field, extending well toward the lateral chest wall.

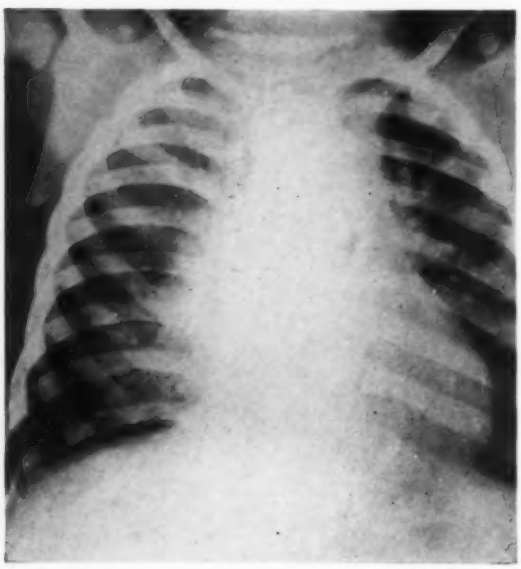

Fig. 9. Case vi. Bilateral perihilar infiltration with involvement of the left apex.

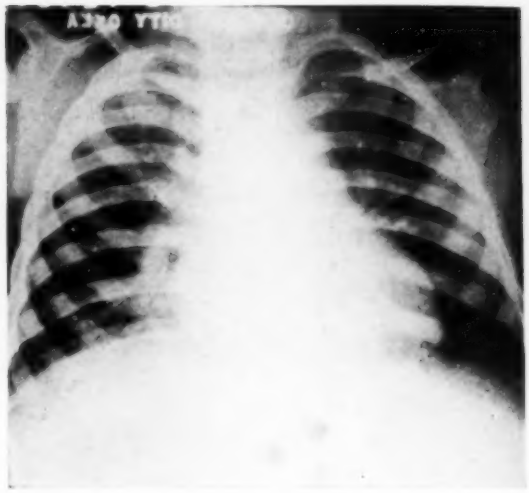

Fig. 10. Case vi. Marked resolution two weeks later.

There was a bandlike homogeneous veiling at the base of the right upper lobe (Fig. 8). Repeated examinations of the chest showed a complete resolution within a few weeks.

This, and the previous case can readily be confused with changes observed in tuberculous pneumonia. A continuous roentgenological observation is of decisive value in differentiating them from a caseous pneumonic form of pulmonary tuberculosis.

Case vi. This was a child, aged two, who had been coughing for several weeks, had some fever, was weak, and did not take food as it had prior to its present illness.

On physical examination there was some dullness on percussion in the right paravertebral space, coarse breathing and a few râles. Temperature was 103°F. Leukocyte count was 4,850 with 68 per cent polymorphonuclears.

A roentgenogram of the chest showed marked infiltration in the right hilum and upper left lung field in the subclavicular region. There

were a few calcified nodes in the left hilum (Fig. 9).

The differential diagnosis took in account a possibility of nonspecific pneumonia and a childhood form of tuberculosis, especially because of the changes in the left lung field.

Serial examination of the chest proved it to be a non-tuberculous process.

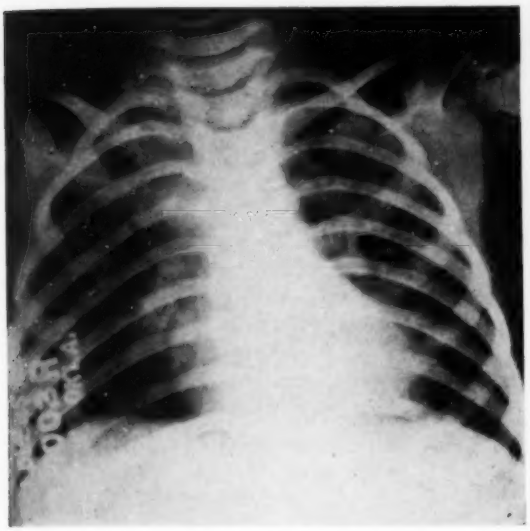

Fig. 11. Case vii. Infiltration left upper lobe and hilum.

Case vii. The patient was a child, aged two and a half, who had been ill for the last seven days prior to its admission to the hospital. It had a severe persistent cough, diarrhea, occasional convulsions and showed a definite prostration. The temperature on admission was 106°F. Leukocyte count was 10,000 with 40 per cent polymorphonuclears.

A roentgenogram of the chest showed a mottling and peribronchial thickening in the left upper lung field, and a marked enlargement of the right hilum (Fig. 11). A diagnosis of bilateral bronchopneumonia was made, but it was thought that a childhood tuberculosis should be ruled out.

The child died after thirteen days and no postmortem examination was performed.

The last two cases demonstrate a type of infiltration which, though not characteristic, can be found in childhood tuberculosis, and this possibility can be ruled out only after sufficient clinical and roentgenological observation.

SUMMARY

1. A series of cases of influenzal pneumonia has been presented.

2. The roentgenological appearance of the pulmonary changes has been described.

3. The similarity to some forms of pulmonary tuberculosis has been pointed out, and the difficulty of differential diagnosis on a single examination stressed.

4. It has been considered of paramount importance to have these cases examined at short intervals in order to follow the changes occurring in the involved parenchyma.

5. It has been apparent that cases of influenzal pneumonia are characterized by great changeability of the infiltration, whereas pulmonary tuberculosis is more stationary, or if not treated may become progressively worse.

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PRIMARY LYMPHOSARCOMA OF THE JEJUNUM

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THE occurrence of primary lymphosarcoma of the gastrointestinal tract, and especially in the jejunum, is of sufficient rarity to make any additional proved case worthy of record. The case reported herewith is particularly interesting for several reasons: (1) The disease was very extensive, involving approximately 4 feet of the jejunum and yet produced comparatively mild clinical symptoms. (2) The disease was discovered during a routine roentgen examination of the gastrointestinal tract for a suspected peptic ulcer and the diagnosis was established by a special study of the small intestine. (3) The treatment consisted of radical resection of the involved coils of jejunum and postoperative roentgen irradiation of the metastatic mesenteric lymph nodes. (4) The patient died five months later from peritonitis secondary to leakage at the site of anastomosis and at autopsy no sign of the disease process could be found.

FIG. 1. Roentgenogram made immediately after ingestion showing extensive involvement of the proximal jejunum.

CASE REPORT

M. P., white male, aged thirty-seven, native of the United States, was admitted to the hospital complaining of a boring pain and burning sensation in the epigastrium of about two months' duration. The present illness began with vague epigastric distress, and sour eructations aggravated by food. There was no nausea, vomiting or tarry stolls. Gastric ulcer was suspected and treatment by diet and alkalis was administered without relief. The symptoms gradually increased in severity and during the last several weeks before admission the patient lost about 15 pounds in weight.

The family and past history of the patient were not relevant to the present illness.

FIG. 2. Roentgenogram made one hour later showing the progress of the meal through the jejunum. The involved coils show the same appearance as previously noted.

Physical examination was essentially negative throughout except for some pain and tenderness on deep palpation in the epigastrium just above the umbilicus. No abnormal masses were felt in the abdomen. Examination of the blood showed that the hemoglobin was 83 per cent, red cells were 4,220,000 and white cells 14,000, with 85 per cent polymorphonuclears, 15 per cent lymphocytes.

The patient was referred to the Department of Radiology for an examination of the gastrointestinal tract. The clinical impression was that of a peptic ulcer although, because of the weight loss, the possibility of an early cancer was also considered.

Roentgenographic Report. The stomach and duodenal bulb showed no organic pathologic condition. Beginning just beyond the duodenojejunal junction, the proximal coils of jejunum showed a very bizarre appearance. The normal mucosal pattern was entirely lost and there were present long segments of dilated gut interspersed with segments of constricted gut. The constricted areas showed smooth concave defects along the walls as though compressed by nodular masses. Films made at frequent intervals showed a moderate delay in the motility of the barium meal through the involved coils. Examination four hours after ingestion of the meal showed a small amount of barium still retained in the involved jejunal coils although the bulk of the meal was in the proximal colon and terminal ileum (Figs. 1, 2 and 3).

FIG. 3. Roentgenogram made four hours after ingestion. The involved coils of jejunum show some retention of the meal.

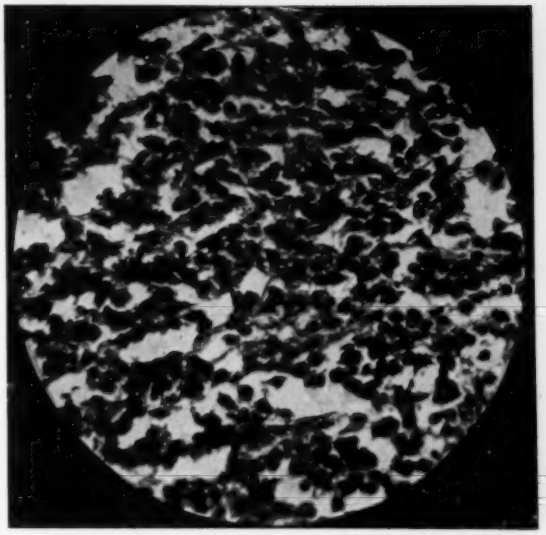

FIG. 4. Microscopic section showing marked cellularity of the process, all cells being small lymphocytes with hyperchromatic nuclei.

Summary. The findings indicated a pathologic process involving the proximal jejunum. In view of the marked extent of the process, the most likely possibility was lymphosarcoma. It was not possible, however, to definitely exclude other types of malignant lesions.

The patient was referred to the surgical section and several days later was operated upon to determine the exact nature of the lesion. The proximal jejunum was found to be infiltrated by numerous discrete nodular tumor masses and the adjacent mesentery contained markedly enlarged lymph nodes. The involved coils were extremely thin and very friable and during delivery into the abdominal wound the wall ruptured through the tumor tissue. It was felt that radical resection was indicated and this was accordingly performed. The continuity of the bowel was re-established by a gastrojejunostomy using the distal jejunum.

Pathological Report. Gross: Specimen consisted of section of intestine measuring 109 cm. in length. The identity of all coats was distorted. The cut section showed a thin translucent outer coat covered by a thin serosa. The remainder of the intestinal wall was replaced by cellular,

white soft tissue. The mucosa was somewhat hemorrhagic and necrotic. Several portions of the specimen were firm and tubular. The attached mesentery also showed large soft white cellular lymph nodes. *Microscopic:* Sections showed diffuse infiltration of the submucosa by atypical cells which had vesicular nuclei and abundant cytoplasm. The nuclei were hyperchromatic and showed mitotic figures (Fig. 4). *Diagnosis:* Diffuse lymphosarcoma, small cell type.

Subsequent Course. Following operative recovery, the patient received intensive roentgen therapy to the abdomen in an attempt to resolve the metastatic lymph nodes. He was not seen again until about five months later when he was re-admitted complaining of generalized abdominal pain. Examination disclosed a somewhat rigid, distended abdomen. The clinical impression was that of a recurrent lymphosarcoma with possible perforation. He was too acutely ill to withstand any surgical procedures and died shortly after admission. Postmortem examination showed no evidence of recurrence of the lymphosarcoma in spite of very careful and minute search. The cause of death was generalized peritonitis secondary to a tiny leak at the site of anastomosis.

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THE APPEARANCE AND NATURE OF CYST-LIKE AREAS IN THE DISTAL FEMORAL METAPHYSES OF CHILDREN*

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WE SHALL present here reproductions of roentgenograms of a benign cyst-like condition found in the distal femoral metaphysis together with the observations we have made as to its frequency, age incidence, appearance, etiology and fate. The program of research conducted by the Samuel S. Fels Research Institute includes as an important part of its growth study serial skeletal roentgenograms on the two hundred children who serve as research subjects. These repeated skeletal examinations, which begin on the day of birth and are repeated at three and later six month intervals until the age of eighteen years, offer a fascinating opportunity to study the developmental aspects of bone growth. The material presented here has been derived from these serial data.

Figure 1 contains reproductions of a number of roentgenograms of a cyst-like phenomenon. The affected areas are usually round or oval but occasionally have a sacculated form. They are usually from 1 to 3 or more centimeters in diameter. They are almost always found in the medial condyle but rarely extend across the entire end of the diaphysis. Lateral roentgenograms show them to be located just beneath the cortex posteriorly or almost centrally. Their contours, particularly when round or oval, are usually sharply defined and regular. Trabeculation of overlying bone is always clearly visible. The phenomena present the appearance of a vacuolized area filled with non-osseous substance. They rarely invade the zone of provisional calcification, and their lower borders are rarely as much as 3 cm. from the provisional zone of calcification. The borders of the surrounding bone are usually unchanged but occasionally present a considerably increased density and may resemble heavy provisional zones of calcification.

In our series we found the average age of appearance of the cyst-like areas to be forty-six months. They appeared as early as twenty-two months and as late as seventy months. They usually reached their maximum size and radiotranslucency at about fifty months. Their average duration was twenty-nine months. They occasionally are present as late as nine or ten years but never began that late. They have a significantly higher incidence in males. In children old enough for the condition to have developed, it was present in 22 per cent of a group of 54 girls at one or more age levels and in 47 boys its incidence was 53 per cent. In all instances it was discovered as a result of routine serial roentgen examinations. In no instance was it productive of symptoms and in no instance was any treatment undertaken. The condition is self-limited and has always disappeared spontaneously.

Table 1 contains a comparison of some of the points relating to age onset, sex incidence, skeletal distribution and course in the pseudocysts we are describing here and in solitary bone cyst and giant cell tumor.

The figures on solitary bone cyst and giant cell tumor are from Platt.[1]

STRUCTURE

Because of the benign and self-limited nature of the condition, it is one which does not come to operation. We have not, therefore, examined grossly or microscopically these cyst-like areas from biopsy or au-

* The authors wish to acknowledge the assistance of Miss Margaret Anderson and Dr. H. D. Snell in the collection of the roentgenograms.

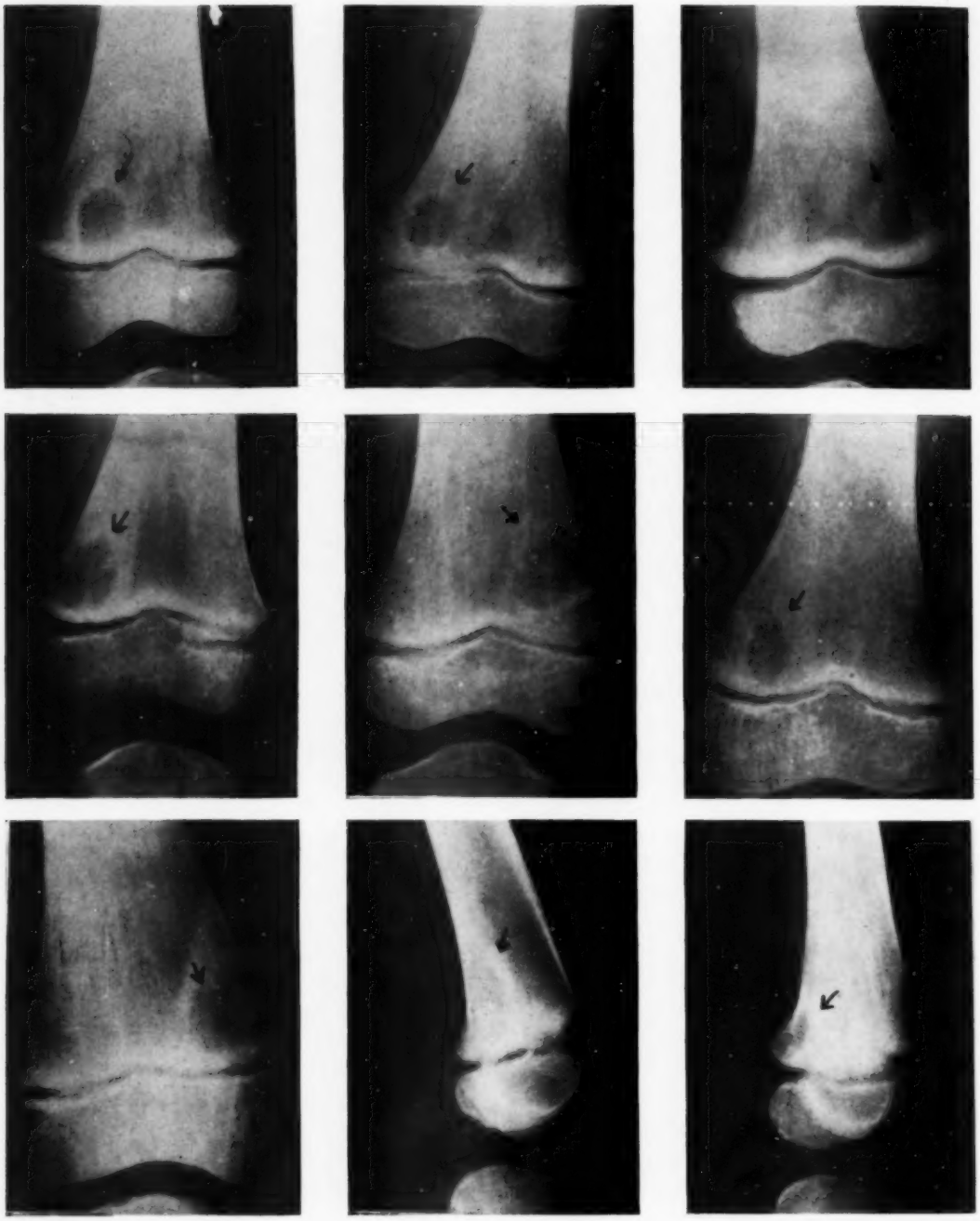

FIG. 1. Anteroposterior and lateral views of cyst-like areas in the distal femoral metaphyses of children. The youngest in this group is thirty-four months and the oldest, ninety months.

topsy material. While their structure and etiology must for this reason remain for the present somewhat a matter of conjecture, certain features of their roentgenographic appearance are helpful in developing a concept of their nature. Ferguson,[2] mentions a roentgenogram of what appears to be the same condition we are describing here. He states that it is due to a cartilaginous rest, is innocuous, disappears spontaneously. It

is possible that some reference to such areas has been made in the vast literature on osteitis fibrosa cystica, giant cell tumors and solitary bone cysts but if so, we have not recognized it. While we have not been able to find other direct reference to these areas in the literature, various roentgenologists in personal conversations with us have expressed the opinion that they are due to vascular disturbance or trauma. In considering the nature and etiology of the areas, the following observations are of interest:

1. The areas seem to occur only in the distal end of the femoral diaphysis and almost always medially.

2. Although they may be present for two or three years, they always maintain the same position relative to the end of the diaphysis. Thus, if the near border is 7 mm. from the end of the bone and the far border is 27 mm., these will remain approximately the same despite 30 or 40 mm. of growth in the length of the bone. The translucent area moves down the bone at the same rate at which the bone grows.

3. In a few instances the area may disappear and recur some months later.

4. Occasionally the areas develop a heavily mineralized border which gives the appearance of a temporary zone of calcification about it.

5. It is very frequently possible to find in roentgenograms taken three or six months prior to the development of one of these areas, a very tiny cell-like "punched out" spot occupying the exact place where the cyst-like phenomena will subsequently appear. These cell-like areas are usually about 2 mm. in diameter. Sometimes there are two or three of them clustered together.

To us, the fact that the areas are not stationary but maintain their position relative to the ends of the bones indicates rather strongly that trauma is not the cause. If injury occurs to a given bone area, we do not see why that area should not remain constant until healing occurs. Similarly, we should expect any vascular disturbance to remain stationary except as new avenues of circulation would decrease the size of the affected spot. Since the demineralized areas appear rapidly and definitely enlarge in bone already formed, there must either be osteoclasts present and active, or some local condition which causes absorption by the blood of much of the lime salts in a circumscribed area. The occasional presence of a heavily calcified border suggests either that mineral lost from the central part of the cyst-like area is deposited in the matrix of the immediately surrounding bone or that there is an area of proliferating cartilage present which becomes in effect a provisional zone of calcification. We are inclined to believe that the latter is true.

The fact that the distal end of the femur is a very rapidly growing area—in fact, the most rapidly growing bone area in the body at this age—would suggest that a small clump of cartilage cells might suffer inclusion in this rapidly growing bone. The small areas sometimes preceding the cyst-like condition are also suggestive of very small cartilaginous rests.

Consideration of the facts presented here have led us to the tentative conclusion that the cyst-like areas are the result of a localized activity of osteoclasts. We believe that the newness of the bone in this area and the fact that it is growing rapidly are factors which contribute to this activity. The cell-like areas found before the "cysts" appear, plus the heavily calcified border, suggest that the activating factor may be the inclusion in the end of the growing diaphysis of one or two small clumps of lagging cartilage cells whose presence in the bone stimulate the osteoclasts, perhaps as a foreign body, to bone destruction. This osteoclastic activity may permit further growth of the cartilage cells. We do not believe that there is a great difference between these cyst-like areas and solitary bone cysts. It may well be that the very active state of growth of the bone is the factor which is responsible for limiting the size of the areas and for their early disappearance, in contrast to the occasional persis-

tence and enlargement of true solitary bone cysts.

FACTORS NOT INVOLVED IN THE PRODUCTION OF CYST-LIKE AREAS

We have carefully investigated the incidence of trauma and illness in those children having well-developed "cysts" and in those having no "cysts." We are unable to find any significant difference. We have made serum phosphorus, calcium and phosphatase determinations in some of these cases with "cysts." We do not find that the values obtained differ from those values usually considered normal. Neither are we able to find any characteristic of health, diet or growth which differentiates the two groups. We have investigated the possibility of endocrine dysfunction but there is no evidence that it is of significance in producing the phenomena.

TABLE I

	Solitary bone cyst	Giant cell tumor	"Pseudocyst"
Age in years	5–15 (under 20)	20–35 (over 20)	2–10
Sex	M. > F.	F. > M.	M. > F.
Site of election	Humerus—upper end Femur—trochanteric region; upper end	Femur—lower end Tibia—upper end Radius—lower end	Medial portion of the distal metaphysis of the femur
Site of origin	Metaphyseal	Epiphyseal	Metaphyseal
Clinical course	Trauma → Fracture Spontaneous healing^{++}	(Trauma) → pain → tumor Invasive and destructive	Disappears spontaneously

SUMMARY

Translucent cyst-like areas usually of 1 to 3 square centimeters in size are frequently found in the medial aspect of the distal metaphysis of the femur in roentgenograms of children between the ages of two and nine years. These circumscribed areas are the result of local removal of bone salts. They occurred at one time or another in 53 per cent of our series of boys and 22 per cent of our series of girls. Their average duration was twenty-nine months. They are asymtomatic and disappear spontaneously. They are frequently bilateral. We believe the condition may be due to the inclusion of small groups of cartilage cells in the invading metaphysis, which stimulates the activity of osteoclasts. The resultant bone destruction permits growth of the cartilage cells. These pseudocysts may not be greatly different from solitary bone cysts except in the degree to which they progress. This benign condition must be differentiated from such infections as Brodie's abscess, syphilitic abscess and pyogenic abscess. We have known a number of cases in which this cyst-like condition was mistaken for other lesions.

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ROENTGENOLOGIC EXAMINATION OF THE SOFT TISSUES*

I. TECHNICAL CONSIDERATIONS. II. STUDY OF THE AXILLARY REGION

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I. TECHNICAL CONSIDERATIONS

IN ROENTGENOGRAPHY of the soft tissues many technical difficulties are encountered as the result of the small differences in the absorption power of those tissues.

This problem has interested many workers, among whom Carty (1936) is particularly to be cited. Carty, in studying the normal tissues, clearly established that the different muscular groups are recognizable on the roentgenograms because they are well demarcated by lines of lesser density. The normal vessels are visible in certain selected sites, as, for example, in the popliteal region. The skin and the subcutaneous tissue can be divided into many layers of different density and it is possible to determine roentgenologically the degree of their invasion by a neoplasm.

Various authors such as Bonola,[4] Barsony and Winkler[2] have also studied the normal tissues around the knee and in the lumbar muscular masses.

Many kinds of tumors have been studied in this way and the first to be reported upon are the breast neoplasms. The possibility of proceeding under a tangential beam, avoiding any coincident shadows, renders their study less complex. Not only can the tumor itself and its extension be demonstrated, but also the degree of invasion of the subcutaneous tissue and, sometimes, of the underlying muscles (Zuppinger, Vogel).

Roentgenological studies in diseases of the pharynx and larynx are more advanced at present (Huet, Baclesse, 1938) because the difficulties are not so great, due to the presence of air in the laryngeal lumen and because of early calcification in the cartilages.

Cancer of the thyroid gland has been studied roentgenologically by Brown and Reineke,[6] by Fetzer,[13] and by Pack and Craver.[27] As early as 1921, Pfahler,[28] wishing to observe the effects of roentgen therapy on thyroid tumors, established a technique also applicable to the normal gland.

Tumors of the extremities have been demonstrated by Koppenstein[21] and by Chasin.[9] Chasin tried to establish a method of differential diagnosis for soft tissue tumors, lipomata being recognizable because they present an opacity equivalent to that of the subcutaneous tissue.

Nevertheless, in spite of advances in roentgenography of soft tissues, the use of contrast media appeared to be indispensable to an improvement in the results. They permit a clearer delineation, an increase in contrast and differentiation within tissues of equal density. This is the opinion of Carty. Carty[8] and Gratz[18] injected air in the intermuscular spaces, which method they called "fasciagraphy." Kalkbrenner[20] having the same aim, injected thorotrast mixed with novocain in the fascia. Because of the toxicity of thorotrast, this "roentgen myography" has not been applied to the human being. Löhr and Jacobi[22] and Saito[30] made neurograms by injecting lipiodol or thorotrast in human nerve sheaths. Opaque substances have been injected also in the arteries, veins and lymphatic vessels (Dotti, Monteiro).

The number of these attempts shows the importance and difficulties of the problem. The use of contrast media, nevertheless, is

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not lacking in harm. They may have a local toxic effect or produce unpleasant symptoms when absorbed (iodine compounds, thorotrast). The use of slow absorbing products makes further roentgenographic examination difficult in concealing the adjacent structures. The danger might be greater when trying to determine the contour of neoplasms. The injection dilacerates the tissues surrounding the tumor and may cause local extension or metastatic emboli. Moreover, if radiation therapy is to be applied, it will be difficult to determine the exact dosage because of the heavy secondary radiation produced by the contrast medium.

Consequently, I tried to find a practical method of making roentgenograms of soft tissues without the use of contrast media and with the apparatus in general use.

Technique. Roentgenograms have to be made of tissues of slight density and composed of elements of low atomic number. Their specific weights are closely related and the same is true for their absorption coefficients. In fact, if the coefficient of bone is about 12, that of muscle is equivalent to the coefficient of water (2.5), and that of blood is slightly higher, 2.6–2.7. Fat tissue has a lower coefficient varying between 1.1 and 2.6 (Zuppinger, Trübestein). The diffusion coefficient is the same for the different constituents of the body (0.18, Kustner, 0.22, Trübestein).

It is thus classical to use low voltage following the well known formula: $\frac{\tau}{\rho} = C\lambda^n$.

This principle has been applied by American radiologists (Carty, Files). For them, the penetration is the predominant factor of differentiation. The tension used is as low as possible, as long as sufficient penetration is obtained. At the same time, it is necessary to use a number of milliampere-seconds sufficient to have a satisfactory blackening of the film. Carty estimates that 300 ma-sec. (100 ma. during 3 seconds) at a distance of 36 inches, without filter and with the usual screen, gives the best results. The voltage is approximately 20 kv. for regions as thin as fingers, and 35 to 38 kv. for thicker portions such as the knee, shoulder and neck.

Consequently an apparatus is necessary for low voltage, which can be used at the same time at high milliamperage. These requirements cannot be met even by the latest models now at our disposal, the lowest utilizable tension being 40 kv. for the Siemens Titanos S, and 32 kv. for the Victor Model B.

With our machines we tried nevertheless to take roentgen pictures of soft tissues, using the tension as a differentiation factor. Experience has shown that satisfactory adjustment of the apparatus is difficult and the difference of a few kilovolts may be important.

These variations are due, first, to the corpulence of the patient, which is an obvious factor. Another difficulty is that there are individual variations in the composition of the tissues and these variations cannot be foreseen as they depend on the degree of hydration and of fatty infiltration of the tissues. This balance of water, fat tissue and muscle is the principal factor on which the absorption coefficients depend. We have found in the reports of Trübestein's work in radiation therapy, some valuable information, applicable to roentgen diagnosis. This author, studying the absorption and diffusion of monochromatic roentgen-ray beams in different tissues, has shown that at 50 kv. under 1 mm. Al, the absorption of the cellular tissue depends mostly on its water content. The cellular tissue rich in water (42 per cent) has for constant C, 2.0165 while it is 1.142 for cellular tissue poor in water (7.7 per cent). This latter constant is near that for triolein, which about equals that for pure human fat. Blood absorbs a little more than water. The striated muscle absorbs the different beams in the same ratio as water.

Thus in current practice many individual differences in patients are encountered. Trials with the tension as a variable are

long and rather expensive and for that reason we felt it necessary to discard this method. I tried to work at medium kilovoltage and to apply the standard technique used for the bones to roentgenography of the soft tissues of the same region. This procedure enabled me to determine rapidly and economically the most favorable conditions for taking the films.

We interpose between the tube and the film a series of aluminum filters of graduated thickness. The beam is thus filtered for one exposure following the location on the film by 0, 2, 4, 6 mm. of aluminum. Thus a test plate is obtained from which one can choose the most convenient filtration. Afterwards with this uniform aluminum filtration, complete exposure is made.

The best film includes 4 degrees of contrast. Obviously the different observers to whom the test film was submitted did not always choose the same roentgenogram as being the best one of the series, since this depends on individual appreciation of the contrast. We know that the eye generally is able to perceive differences of 5 per cent in the faintest blackenings, differences of 10 per cent in the medium tones, and in the dark tones only differences of 0.25 per cent or more can be noted (Franke).

In the beginning we made trials with the filter placed in the cone. Filters of this kind had been used, but for quite another purpose by Gershon-Cohen[17] and by Pickhan,[29] to equalize differences in thickness or density of some regions (abdomen in pregnancy, chest films when one side is much more opaque than the other). This procedure was abandoned because with the great distance between filter and film, the edges of the aluminum plates give blurred contours. Moreover, we felt it preferable to place the filter between the film, because the filter with the Potter-Bucky diaphragm aids in absorption of part of the secondary radiation.

We work at medium voltage, the same as used for the bones. This filter absorbs proportionally more soft rays than the others, and the average wave length of the beam is thus harder. The percentage of diffused radiation reaching the film is consequently higher, as we were working at very low voltage. For this reason we use the filter and a Potter-Bucky diaphragm. The use of medium voltage gives the roentgenogram more relief and also a transparent appearance.

On the other hand, we have all seen bone films taken under the standard conditions which show fairly well the bone structure as well as the soft tissues. This proves that the use of low voltage is not indispensable for visualization of soft tissues.

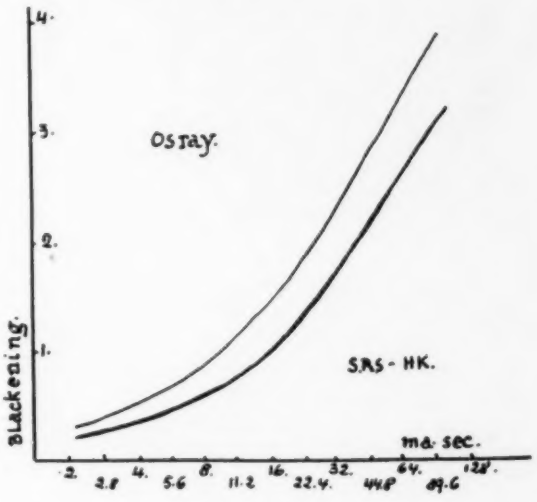

FIG. 1

Screens are not used, thus the roentgenograms show more details. Tests with ordinary screens have proved to be unfavorable. One has to use a very short exposure to prevent entire blackening of the film and consequently there is not enough play space in choosing the time exposure.

The use of ordinary films has not proved satisfactory. The roentgenograms are gray and veiled, showing poor contrast. The time of exposure is very long, which is particularly unpleasant when the output of the tube is of low milliamperage.

We have used a special non-screen emulsion;* the blackening curve of this film is

* We wish to thank the Gevaert firm for furnishing the Osray film samples necessary for the development of our method.

characteristic. Used without screen, it gives more contrast than the ordinary film and requires only half of the time exposure for an equal blackening. The beginning of its blackening curve (Fig. 1) is already slanting so that appreciable contrast can readily be obtained for weak densities. In the ordinary film, this portion of the curve is flat. In the zone of favorable blackening (S = 1 to 1.5), that is in the straight portion of the curve, the incline is the same for both films (Osray without screen and ordinary film with screen) (Fig. 2) whose properties are consistent at different voltages.

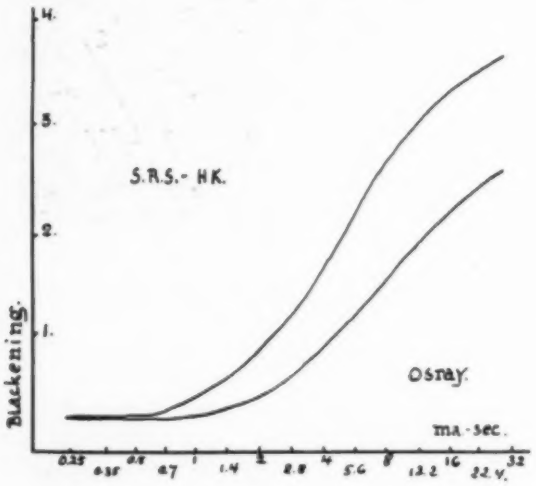

Fig. 2

The roentgenograms are well balanced. In daily work, this film more readily gives soft tissue shadow at the same time as shadows of the bones. It is comparatively more sensitive to roentgen rays than to the light given by the screens. Consequently it is more easily veiled by the secondary diffused radiation, which again justifies the use of a Potter-Bucky diaphragm.

With a methol hydroquinon bath, this film requires nine minutes for thorough developing. A good film after this time is entirely blackened. It is not possible to read the roentgenogram but the image reappears after fixation. Too long development must be avoided. It is well known that silver bromide irradiated by small quantities of roentgen rays is reduced only by a longer developing time. In this way shadowing of the secondary radiation is avoided (Herz).

We have applied these rules to the roentgenography of a paraffin phantom composed of five blocks, each 2 cm. thick, arranged like a flight of steps. The trials were made at different tensions (40, 60, and 80 kv.). The exposure time was chosen so as to obtain equal blackening of the backgrounds. The films were developed for the same time and in the same bath. With this procedure we obtained at different tensions easily visible opacity scales even at 80 kv. The limits of the different thicknesses were well defined.

Summary. Roentgenography of soft tissues involves many technical difficulties. This is due to the fact that the absorption coefficients of soft tissues are very weak and very closely related. Moreover, for the same region these coefficients vary with each individual, as a result of the disposition of muscular and fatty tissues as well as their degree of hydration. These variations cannot be foreseen. In order to avoid this difficulty, the following technique has been established: A roentgenogram is taken under a graduated aluminum filter. From this test film, the filter thickness giving the best contrast for each patient is chosen. Tension and milliamperage are practically the same as those employed for roentgenograms of bone. The variable factor is, therefore, not kilovoltage, but filtration.

II. Study of the Axillary Region

The roentgenological technique for our studies has been reported in detail above. The axillary region has been chosen because it is rather complex and also because it is often the site of inflammatory and metastatic lesions. We tried to ascertain the possibilities of studying the nature as well as the relative locations of the soft tissues.

Anatomically the axilla is a pyramidal space. The anterior wall is formed by the pectoralis major and minor. The posterior wall is formed by the subscapularis, the subspinalis and supraspinalis, the teres major and minor, and the latissimus dorsi.

On the lateral side are the deltoid, biceps, brachii and coracobrachialis. On the medial side is the serratus anterior. It contains the axillary vessels and the brachial plexus, and a large number of lymph glands. The afferents of these drain the arm and thorax.

Normal Roentgen Aspect. To help in the interpretation of the roentgenograms we made preliminary studies of dissected material*, fixed in phenol-glycerine, excluding skin, interstitial fat, vessels and nerves which had been removed without section of any muscle. The roentgenograms were taken in the anteroposterior position (Figs. 3 and 4) and in the posteroanterior position (Figs. 5 and 6). Identification of each muscle shadow was clearly obtained by a series of control films wherein each muscle had been indicated by a metal guide.

The muscles are well delineated, particularly those of the posterior wall. The

* We wish to thank Prof. Dalcq for his great kindness in letting us use these specimens.

Fig. 3. Axillary region; anteroposterior view.

Fig. 4. Anteroposterior view. *1*, deltoid muscle: *2*, deltoid-pectoralis major space; *3*, space between the clavicular and sternal portions of the pectoralis major; *4*, lateral border of the pectoralis major; *5*, lateral border of the pectoralis minor; *6*, latissimus dorsi; *7*, teres major; *8*, teres minor; *9*, subscapularis; *10*, serratus anterior; *11*, long head triceps brachii; *12*, scapula-triceps space; *13*, humerus-triceps space.

long head of the triceps brachii is clearly seen descending between the teres minor and the teres major, dividing the triangular space between those two muscles and the humerus into two smaller spaces, one triangular and the other quadrangular. In the patient, because of the aponeurosis and the ligaments, it is not possible to obtain so much detail. These roentgenograms are the ideal equivalent of fasciagrams.

Interpretation of the Films. It is well known that a great number of optical errors interfere with the reading of daily roentgenograms. These are due to superpositions, summations, and curves which deform the shadows, preventing the roentgenological aspect from corresponding to the anatomical form (Franke, Wegelius).

Fig. 5. Axillary region: posteroanterior view.

Moreover, superposition of cylindrical objects (hollow or full) results in the appearence of clear or dark linear shadows. These phenomena, studied by Otte and Wegelius, occur particularly often in soft tissue roentgenograms because the muscles, for instance, are rounded masses. The clear or dark lines are not the result of any visual misinterpretation, as they can be measured by the photometer. They may simulate fissures or fractures in bone. They can be seen not only at intersecting bone sites (the instep, for instance), but also where soft tissue and bone overlap, and between the various layers of soft tissues. Thus, if soft tissue roentgenograms are to be correctly interpreted, one must be thoroughly familiar with the normal aspect of each region. Also, a definite field must be selected, that is, one eliminating as far as possible any interferences such as unnecessary superpositions.

Application to the Patient. The first roentgenogram is taken under the graduated filter described in Part I, with the standard medium voltage, for the shoulder 59 kv., 20 ma., 3.5 to 4.5 seconds, anticathode film distance 85 cm., Osray film, Potter-Bucky diaphragm, Victor Shockproof Model B apparatus. The proper field is chosen under roentgenoscopy. Fast roentgenograms are taken if the patient is nervous or uncooperative, with a Siemens Titanos 6 Kenotrons, rotating anode, 59 kv., 200 ma., 0.35–0.40 seconds.

The lower border of the pectoralis major is indicated by a metal wire fixed in position with adhesive tape. The direction of the beam as chosen under roentgenoscopy is slightly oblique in order to avoid superposition of the anterior and posterior walls

Fig. 6. Posteroanterior view. *1*, deltoid muscle; *2*, deltoid-pectoralis major space; *3*, space between the clavicular and sternal portions of the pectoralis major; *4*, inferior border of the pectoralis major; *5*, long head of the triceps and coracobrachialis; *6*, biceps; *7*, lateral border of the latissimus dorsi; *8*, lateral border of the teres major; *9*, lateral border of the teres minor: *10*, subscapularis; *11*, serratus anterior.

of the axilla. Roentgenograms are taken in the anteroposterior or posteroanterior position. The arm is raised to 90° to eliminate the shadow of the scapula. Supplementary details of one of the walls can be obtained by introducing the film into the axilla and using a well centered, small cone.

The muscles are seen more easily in adolescents than in old persons. Atrophic muscles are better visualized. The artery is seen if calcified. The nerves do not show on the muscle shadows. Depending upon the thickness of the filter, two types of roentgenograms may be obtained, one showing the skin and fasciae, the other showing the muscle groups.

Figure 7 shows a view of the normal axillary region. The latissimus dorsi, teres major and minor as well as the muscle group of the arm are clearly seen.

FIG. 7. Normal axillary region; anteroposterior view.

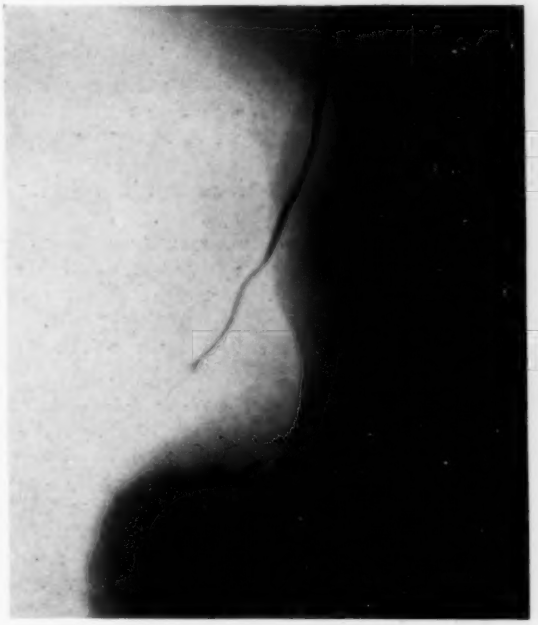

FIG. 8. Carcinoma of the breast; axillary metastasis.

Figure 8 shows a metastatic involvement. The breast tumor, lymphatics and nodes are well delineated in the axilla.

The axillary region has been chosen as an example, but other regions can be studied in this way and such studies are being pursued systematically, as we believe that the technique may be of some help to the roentgenologist.

Summary. In order to apply the technique described in Part I to the axillary region, the normal aspect of the axilla was carefully studied from series of roentgenograms of autopsied sections, in which metallic guides had been set to show the normal structures. Then this method was used for roentgenograms of the disease-free axilla and similar detailed investigations were carried out in patients with axillary metastases, chiefly those from cancer of the breast.

These roentgenographic studies will be extended to other regions.

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DEFORMITIES AND FRACTURES OF THE VERTEBRAE AS A RESULT OF SENILE AND PRESENILE OSTEOPOROSIS*

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WE WISH to present a group of cases showing marked deformities, compression and fractures of one or more vertebrae as a result of senile and presenile osteoporosis. The differential diagnosis proved to be extremely difficult in each instance and we present this series after prolonged periods of observation, during which time we were able by elimination to rule out other possible etiological factors. Although it is well recognized that deformities of vertebrae occur as a result of senile and presenile osteoporosis, the fact that marked compression and fractures of one or more vertebrae may occur has not been stressed particularly in the English literature.

REPORT OF CASES

CASE 1. E. P., female, aged sixty-eight, was admitted to the institution in February, 1936, with a diagnosis of paralysis agitans. A history of tremors of the right side of the body dated back to two years before admission. The tremors had progressively become worse and subsequently involved both sides. One and a half years prior to admission, she began to experience stiffness of her extremities and about that time she was forced to spend most of her time in bed or in a wheel chair. Complete inability to walk because of weakness and stiffness resulted about six months before admission.

Physical examination disclosed an obese female patient with marked kyphosis who had tremors of the upper and lower extremities and a generalized rigidity of the musculature indicative of paralysis agitans. Neurological examination otherwise was negative. There were no subjective symptoms referable to the spine.

In 1936, while in the hospital she developed gastrointestinal symptoms and while investigating the gastrointestinal tract roentgenologically, the presence of collapsed vertebrae was first noted as an incidental finding. Laboratory investigation proved essentially negative. Special attention was given to the calcium phosphorus and phosphatase determinations, which were found to be within normal limits. Roentgenographic studies of the spine disclosed marked compression and deformity of the ninth and eleventh dorsal vertebrae and more pronounced compression of the third, fourth and

FIG. 1. Case 1. Compression of ninth and eleventh dorsal vertebrae. Suggestive fracture of third, fourth and fifth lumbar vertebrae. Biconcave outline with condensation of margins of lumbar vertebrae. Generalized osteoporosis.

* From the Radiological Service of the Jewish Sanitarium and Hospital for Chronic Diseases, Brooklyn.

Fig. 2. Case II. Generalized osteoporosis. Fractures of third, fourth and fifth lumbar vertebrae. Biconcave deformity of first lumbar vertebra. Calcification of the abdominal aorta.

fifth lumbar vertebrae. Suggestive evidence of fractures of the latter three vertebrae was present. Generalized osteoporosis of the entire spinal column was present involving both the bodies and accessory portions of the vertebrae. The spinous processes of the lumbar vertebrae were almost completely decalcified. The lumbar vertebrae also showed characteristic biconcave outlines with condensation of the margins. Repeated studies of the spine over a period of four years disclosed very little change in the findings aside from some lipping and bridging along the anterior surfaces of several vertebrae.

This patient was originally thought to have an intra-abdominal cancer and the vertebral findings were considered metastatic. This possibility was excluded by the prolonged observation period, the absence of symptoms referable to the spine and the lack of change in the roentgen findings over this period of time. Other specific diseases were also ruled out both by laboratory and clinical observations.

Case II. S. K., male, aged seventy, was admitted to the institution in June, 1937, because of persistent dysuria and nocturia and general malaise. Five years before admission, a bladder stone was removed by the transurethral route. For eight months before admission, patient experienced pain in the lumbosacral region which became aggravated on walking. Physical examination disclosed the patient to be an elderly arteriosclerotic individual with hypertension. The prostate was enlarged but soft. Otherwise the findings were negative. The laboratory data including calcium phosphorus and phosphatase determination, were also essentially negative.

Because of pain in the lower spine, roentgen studies were made. The studies disclosed a generalized osteoporosis of all the vertebrae with marked compression deformity of several lower dorsal and almost all the lumbar vertebrae. Almost complete collapse of the third, fourth and fifth lumbar vertebrae was noted and numerous fractures of the borders of the fourth and fifth lumbar. Calcification of the abdominal aorta was present.

This patient was originally admitted to the institution with a diagnosis of metastatic cancer of the spine possibly from the prostate. The

Fig. 3. Case III. Wedging of fifth, eleventh and twelfth dorsal vertebrae. Biconcave lumbar vertebrae. Osteoporosis of the spine. Bridging and lipping on anterior surface of dorsal vertebrae.

pain in the spine originally complained of disappeared during his further stay. Three years have passed since the original study in our institution and four years since the first examination in another hospital without change in the roentgen findings. Clinically the patient improved.

Case III. B. K., female, aged seventy, was admitted to the institution in 1934, with a diagnosis of hypertensive heart disease. For the past eight years the patient had had pain in the shoulders and knees which had to some extent disabled her. The patient had a marked kyphosis of the dorsal spine. There was no pain referable to the spine. The laboratory data were essentially negative.

Roentgenographic studies of the spine revealed a generalized osteoporosis of the entire spine with marked compression and wedging of many of the vertebrae particularly the fifth, eleventh and twelfth dorsal. Several of the lumbar vertebrae resembled fish vertebrae in their configuration. Some hypertrophic changes were noted in the dorsal area and the remaining skeletal structures were osteoporotic. The vertebral collapse was first observed during routine cardiac roentgenoscopy in 1936. The spine was subsequently examined in 1938, 1939 and 1940 and no appreciable change was found. This patient was the only ambulatory patient in the series. The vertebral collapse in this case was confined to the mid dorsal region and associated with kyphosis.

Fig. 4. Case IV. Osteoporosis of spine. Herniation of nucleus pulposus of first lumbar vertebra. Compression fracture of third lumbar vertebra.

Fig. 5. Case V. Marked concave deformities of lumbar vertebrae. Fracture of cortex of third and fourth lumbar vertebrae. Calcification of the abdominal aorta.

Case IV. N. N., male, aged forty-nine, was admitted to the institution in 1930 with the complaints of blindness and inability to move his left arm and leg. In 1930 he was operated on at Mt. Sinai Hospital for a right-sided brain tumor which on histological examination proved to be a hemangio-endothelioma. Physical examination disclosed a cachetic appearing male with left hemiplegia and complete amaurosis. A right craniotomy was present. He occasionally sat up in a wheel chair but spent most of his time in bed.

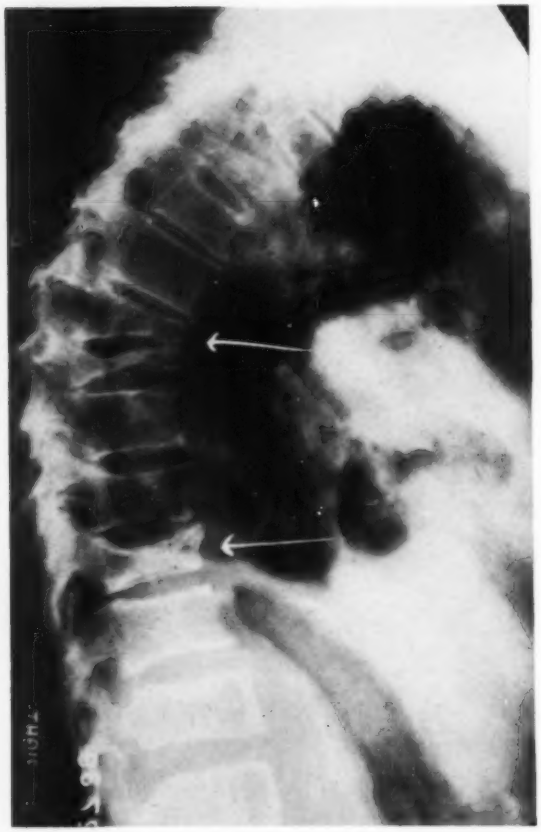

Fig. 6. Case vi. Marked compression and wedging of seventh and eighth dorsal vertebrae. Hour-glass deformity of eleventh dorsal vertebra. Osteoporosis of entire spine. Calcification of the abdominal aorta.

Roentgen examination of the spine disclosed a generalized osteoporosis of all the vertebrae with considerable deformity of the first and third lumbar. The first lumbar showed a rather typical nucleus pulposus herniation with irregularity of the upper margin. The third lumbar showed compression of its upper margin suggestive of a compression fracture.

Metastatic disease to the spine was considered in this instance. We felt, however, that it could be ruled out because ten years had elapsed since the operation. The absence of pain in the spine was also against a malignant condition. No roentgen therapy had been given.

Case v. G. F., female, aged fifty-nine, came to the institution in 1939 with the diagnosis of diabetes mellitus. Twenty years before admission, she consulted a physician because of loss of weight at which time the diabetic status was discovered. She had been on a diet and insulin regimen since then. Three years before admission, tremors and stiffness of the extremities were first noted. These symptoms progressed and in the course of time she became completely incapacitated. Physical examination disclosed an emaciated senile female who showed the cardinal symptoms of paralysis agitans with generalized tremors and rigidity. Aside from the evidence of diabetes, the laboratory findings including calcium phosphorus and phosphatase determinations were negative.

Roentgen examination of the spine disclosed a generalized osteoporosis with marked concave deformities of the bodies of many of the lower dorsal and lumbar vertebrae. Several vertebrae showed fractures of the cortex. An incidental finding was the calcification of the abdominal aorta.

Case vi. T. B. The patient was a debilitated female, aged seventy, who was admitted to the institution in November, 1935, with a diagnosis of arthritis deformans. She had developed pains and swelling of the knee joints fifteen years before admission. Five years prior to admission patient was confined to a wheel chair because of flexion contractures of the knees. The physical examination disclosed involvement of practically all the joints of the body and a pronounced kyphosis of the spine. Flexion contractures of the knees, elbows and shoulders were present and the patient was confined most of the time to a wheel chair. She had no pain referable to the spinal column. Laboratory data were essentially negative. The spine was examined to determine the degree of arthritic involvement.

Roentgenographic examination showed marked compression and wedging of the seventh and eighth dorsal vertebrae with an hour-glass deformity and compression of the eleventh dorsal. Calcification of the abdominal aorta was also noted.

Arthritis deformans may produce deformities of the vertebrae, but in this instance, few arthritic changes were present. It is our impression that the patient's age, long standing debility and inactivity were the primary contributing causes for osteoporosis and compression fractures of the vertebrae.

Discussion

It is our impression that changes in the vertebral column as observed in this group are incidental to senile and debilitated

states. Five of the 6 cases were incapacitated and confined to bed or a wheel chair for prolonged periods of time. The lower dorsal and lumbar regions were affected in most instances, primarily we believe because these regions play the greatest part in weight bearing. In addition to the collapse we were able to demonstrate irregularities of contour, hour-glass deformities and evidence of nucleus pulposus herniations in most instances. Frequently between groups of collapsed vertebrae osteoporotic vertebral bodies with normal contours were seen. As a rule osteoporosis of the entire spine was present and several showed hypertrophic changes with lipping and bridging between the vertebral bodies. In all instances one or more discs of the lumbar region had a biconvex configuration. As an incidental finding in 3 cases, calcification of the abdominal aorta and in 4 calcific plaques in the aortic knob were found. Osteoporosis of other skeletal structures was also noted. None of these cases showed neurological evidence of cord compression and in none was there a history fo trauma. One patient was originally referred from another institution with a diagnosis of metastatic malignancy, and our own department interpreted the extensive collapse as consistent with the diagnosis of metastatic spine disease in several instances before we recognized senile osteoporosis as the cause. In other instances many disease entities were considered and we were able to rule out endocrine malfunction, neurotrophic circulatory disorders, congenital defects, dietary and vitamin deficiencies and specific diseases such as Paget's disease, osteitis fibrosa cystica, Pott's disease, etc. Chemical analyses revealed normal values for calcium and phosphorus and a moderate elevation of the phosphatase in 3 instances which was felt to be of no significance.

Lance, Girard and Lance, and others, have written on the subject of senile osteoporosis with vertebral collapse and have discussed the various factors which enter into the production of this condition. They state that senile osteoporosis in its mild form is the expression of the normal physiological involutionary mechanism, since the apposition of new bone is diminished in senility. The phenomena of bone absorption constitutes an intrinsic process in the life of the bone.

Anatomically in senility, the vertebral body shows a diminution of thickness of the cortex. The spongiosa has finer trabeculations which are wider spaced and filled with white fatty bone marrow. The red bone marrow is found only in islands. The date of the appearance of osteoporosis varies greatly with individuals and in the spine it might be absent up to an advanced age. In extreme instances, this porosity of the vertebrae renders the bone fragile causing it to collapse and to undergo various deformities. The deformities are produced primarily by the diminution of the resistance of the osseous structures and by the direction of the forces from above which are variable according to the curvatures of the spine and the habits of the patient. In the dorsal region the osteoporosis which may be considered the first stage, is as a rule followed by a wedging of the vertebrae. This may be explained by the fact that the dorsal region is the least movable portion of the spine and the pressure is transmitted mostly anteriorly. In the lumbar region pressure is transmitted to the center of the vertebrae through the nucleus pulposus. In the lumbar region if the nucleus pulposus has preserved its elasticity, concave or hour-glass deformities occur. In the final stages, because of the loss of elasticity of the disc and the pronounced decalcification, complete collapse with fracture frequently occurs.

SUMMARY

Six cases of senile and presenile osteoporosis are presented showing fractures, compression and other marked deformities of one or more vertebrae. In none of these cases could the spinal pathology be accounted for by a specific disease entity. The vertebral pathology was found in each instance as an incidental finding to some other roentgenographic investigation. No

pain or very little pain was referred to the spine. Vertebral collapse associated with osteoporosis occurs fairly frequently in senile and debilitated states and should be differentiated from cancer and other specific diseases. The diagnosis of vertebral collapse, etc., due to senile and presenile osteoporosis as a rule is made by elimination. The absence of pain and the presence of characteristic deformities of other vertebrae are significant.

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VERTEBRA PLANA (CALVÉ)

REPORT OF TWO CASES

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IN 1925 Calvé[2] described a disease of the vertebra in children similar in character to Legg-Calvé-Perthes' disease of the head of the femur, and other of the osteochondritides, and termed the condition "vertebra plana." Since that time a number of vertebral lesions more or less resembling Calvé's vertebra plana have been described, and many different names have been applied, the more common being vertebral epiphysitis, juvenile kyphosis, osteochondritis deformans, osteochondritis of the vertebra, and infantile pseudospondylitis. It is quite possible that most of these conditions do fall into the osteochondritis group, but have different manifestations depending upon the age group of the children, and upon the causative factor, which in some must be local, in others general or systemic. Brailsford[1] divides the lesions into two main groups: the one in which there is a uniform compression of the body, as described by Calvé; the other in which the deformity resembles osteoporosis of the vertebra such as is seen in adults. To the former he applies the descriptive term of vertebra plana as did Calvé; to the latter the name juvenile osteoporosis. This seems to be as satisfactory a classification as any until more is learned of the etiology and of the underlying pathologic processes. This paper is concerned only with the first type. In 1938 Mezzari[3] collected from the world literature reports of 27 cases of this condition, of which 17 were typical examples of the disease as described by Calvé. Since that time reports of 4 more cases have been found.

The etiology of vertebra plana is unknown. The disease is found in children ranging from two to fifteen years of age, the greatest incidence being between five and ten years. The distribution is approximately equal in the two sexes. There is a fairly high incidence of acute infectious diseases preceding the onset of symptoms, and a number of cases give a history of antecedent trauma. What bearing these things have upon the condition has never been definitely established.

Due to the fact that the disease is nonfatal, extensive pathologic studies of tissues have not been carried out. Roentgenographically the course and appearance is similar to Legg-Calvé-Perthes' disease of the hip, and it is assumed that the collapse of the vertebra is due to aseptic necrosis of the bone. Mezzari's case was studied pathologically, and this was confirmed. The cause of the necrosis in his case was due to a circulatory deficiency caused by syphilitic neurovascular disease in the nutrient vessels.

The disease starts with a slight narrowing of the vertebral body, and an increase in the width of the intervertebral discs, with the latter not eroded nor destroyed. The involvement is usually limited to one segment, although occasionally more than one vertebra show involvement. The progress is usually rapid, with a flattening of the vertebra which continues until only a thin disc of bone remains. At this time the intervertebral discs adjacent are much wider than normal. The density of the bone is usually well maintained, and at the end when the collapse is complete, the density is greater than normal. Regeneration of the body is said to take place without much new bone formation in the adjacent structures. In some instances in a year's time the contour of the vertebra has been reported to be completely restored.

The diagnosis rests upon the roentgenographic findings. Most of the cases are diagnosed as tuberculosis of the spine clinically. The roentgenographic picture, however, is characteristic. The density of the bone is normal or increased, instead of decreased as

Fig. 1. Case 1. October 14, 1938. The vertebral body has been reduced to a thin, dense disc. The intervertebral discs are wider than normal and are intact.

Fig. 2. Case 1. Lateral view made April 8, 1940. No essential change.

in tuberculosis; the intervertebral discs are wider than normal and are not involved, whereas in tuberculosis the discs are usually the point of early attack and are destroyed. The regeneration is reported to be more rapid than in tuberculous disease, and more uniform in character, and without a fusion of the involved segments with the adjacent vertebrae.

CASE REPORTS

Case 1. Female, white, aged five. Admitted to John Sealy Hospital, Galveston, Texas, with

Fig. 3. Case 1. Anteroposterior view made April 8, 1940. Note the spur-like formation at the margins of the vertebrae.

a diagnosis of tuberculosis of the 12th dorsal vertebra, made upon clinical findings and roentgen examination done elsewhere. About two months previously the child had become ill, presenting at that time malaise, anorexia and constipation. A tonsillectomy was done on September 1, 1938, which was followed by a "kidney involvement," apparently pyelitis. Fever (amount not determined) was present at that time. The child sustained a trivial injury about five weeks prior to admission, and since that time had had pain the back and right side.

Physical examination on admission was negative except for a slight kyphosis and tenderness in the region of the 12th dorsal vertebra. Laboratory examination was negative. Roentgenographic examination on October 14, 1938 (Fig. 1) showed the body of the 12th dorsal vertebra reduced to a thin, dense disc, with the adjacent intervertebral spaces wider than normal. The other bony structures were normal. The child stayed in the hospital a few days, during which time there was a slight, inconstant fever, the temperature elevations ranging from a fraction of a degree to one degree.

Re-examination of the spine from time to time showed no change in the appearance of the vertebra until April 8, 1940 (Figs. 2 and 3), about eighteen months after the original examination. This last examination showed a spur formation of bone extending from the lateral side of the 12th dorsal, and another from the 1st lumbar, similar to the so-called hypertrophic spurs seen in adults. This probably represents a spontaneous attempt to stabilize the weakened structure—a response to mechanical stress and strain rather than a true reparative process.

Fig. 4. Case II. Involvement of 9th and 11th dorsal vertebrae, with intervertebral spaces wider than normal and intact. Study made about seven weeks after onset of symptoms. The disease is in an earlier stage than in Case I.

Fig. 5. Case II. Anteroposterior view showing misleading soft tissue shadow adjacent to the spine.

Case II. Male, white, aged eight. Referred for roentgen examination of the lumbar spine and pelvis on April 6, 1940. Three weeks previously the child had collided with another child while at play and had fallen down. The injury was slight, and although the child complained of some pain in the lower lumbar area and right sacroiliac and iliac regions, a physician was not consulted for two weeks. At this time the physical examination showed a muscle spasm of the right lumbar area, and a moderate lumbar scoliosis. A roentgen examination was advised and was done a few days later. The examination consisted only of films of the lumbar spine and pelvis. These structures showed no abnormalities. Unfortunately the films did not include the entire spine, but stopped at the level of the upper portion of the 11th dorsal, which segment did not show any visible narrowing at that time. Following the examination the child was kept under observation. The pain shifted from the lumbar and right iliac areas to the lower dorsal, and the scoliosis cleared up. On May 4, 1940, a slight kyphosis was first noted in the lower dorsal region, and a second roentgen examination was made (Figs. 4 and 5). At this

time a 50 per cent uniform narrowing of the body of the 9th dorsal vertebra was noted, and a reduction in the height of the 11th dorsal anteriorly to a point, posteriorly to about 50 per cent normal. The discs in both instances were intact and wider than normal. The density of the 9th dorsal was slightly lessened anteriorly; that of the 11th dorsal was increased. Laboratory examination was negative. No temperature elevation was present. Inquiry brought out the fact that the child had always been very active and healthy, but that a slight respiratory infection (a "cold") had been present a short time prior to the onset of symptoms.

COMMENT

Case I shows the classical signs as described by Calvé; Case II apparently represents an earlier phase, with uniform flattening of one body and wedging of another, but in view of the density of the bone, the character of the discs and the clinical course of the case, a diagnosis of Calvé's vertebra plana is warranted. It is worthy of note that a comparatively trivial trauma to the back preceded the onset of symptoms in both cases. Whether trauma is really an etiological agent or whether the slight trauma to an already diseased back simply accentuated the symptoms sufficiently to make them noticeable to the patient is questionable. It is also noteworthy that a history of an acute infectious disease prior to the onset of symptoms is present in both cases. What bearing these factors might possibly have upon the aseptic necrosis is speculative; it is conceivable that trauma or infection, or both, were instrumental in producing embolic or thrombotic phenomena in the nutrient vessels of the vertebrae, which in turn led to necrosis of the bone and collapse of the involved segment. Until further study of pathologic material is possible definite conclusions cannot be made. As to healing or regeneration, Case I has been under observation for eighteen months and practically no regeneration is visible. It might be well to note, however, that this child has not been confined to bed, nor the spine immobilized during this period. A somewhat misleading finding in the diagnosis of Case II is the soft tissue shadow adjacent to the vertebral column, simulating the shadow of a Pott's abscess. This shadow is reported to be frequently seen in Calvé's disease, and its origin has not been determined.

SUMMARY

Two cases of vertebra plana (Calvé) are presented. Both give a history of slight antecedent trauma; both of preceding acute infectious disease. No evidence of reconstruction of the vertebra is visible in one case after eighteen months.

The author wishes to thank Dr. G. W. N. Eggers of the Orthopedic Department, and Dr. H. Anspach, Resident in Radiology, John Sealy Hospital, Galveston, Texas, for follow-up data on Case I.

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THE RADIATION TREATMENT OF CANCER OF THE RECTUM

TECHNIQUE FOR RADIUM NEEDLES THROUGH PERINEAL STAB WOUNDS*

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THE successful radiation treatment of cancer of the rectum depends, naturally, on adequate dosage, but for the best results other factors are important. Not only are there differences in histology, but the various advantages of accessibility are taken into consideration. For equal tumor doses, the more accessible growths often provide most spectacular therapeutic results. The relatively greater volume of normal tissues irradiated in the cases where the growth is not accessible is one of the primary problems. After all, tissue repair and recovery at or near the site of the lesion can proceed faster and achieve more nearly complete recovery when the normal surrounding tissue has received a minimum of radiation. Conditions are usually ideal for the more accessible growths, but here an attempt has been made to apply this general principle to a less accessible location, the rectum.

During the past ten to fifteen years irradiation has been credited with the control of many early and advanced cancers of the rectum; with greater attention to tissue dosage considerations, the results may be even more satisfactory.

The particular principle under discussion here may be summarized as an attempt to irradiate as small a volume of normal tissue as is consistent with the destruction of the primary growth.

The general scheme was to deliver the destructive dose of radiation by several means, dividing the treatment between roentgen radiation and as many different forms of radium and radon applications as was physically possible. In this way radiation necrosis with protracted wound healing was less frequently encountered than from a single caustic dose of interstitial implants. Likewise, the surrounding tissues were preserved to a greater extent than with external roentgen irradiation alone for a more normal and healthy repair of the tumor area following irradiation.

During the period from 1932 to 1940, 42 consecutive patients with cancer of the rectum were treated by various forms of radiation therapy. However, 28 patients were treated from 1932 to 1936 inclusively and have been observed from four to eight years, and only the latter group will be included in the discussion. Intensive treatment was given 13 patients, with every attempt made to eradicate the growth, and of these, 7, or 50 per cent, were considered in the early or so-called operable class; the remainder were considered by more than one consultant as inoperable. The remaining 15 patients received palliative therapy with roentgen radiation alone. Only a few treatments were given to many of this group because of extensive invasion with fixation to surrounding organs or bone, metastases to lymph nodes or liver, and poor general condition.

The treatment procedures were divided according to the extent of disease and the decision for curative or palliative treatment in each individual. The radiation was divided into three methods, namely: (1) external irradiation with high voltage roentgen rays; (2) intrarectal radiation plus roentgen irradiation, and (3) perirectal radiation plus intrarectal and roentgen irradiation.

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EXTERNAL IRRADIATION

All patients received roentgen therapy as a therapeutic test of sensitivity to corroborate the pathological opinion from the microscopic study of biopsy material. Except for a few instances where biopsies removed from various areas of the growth

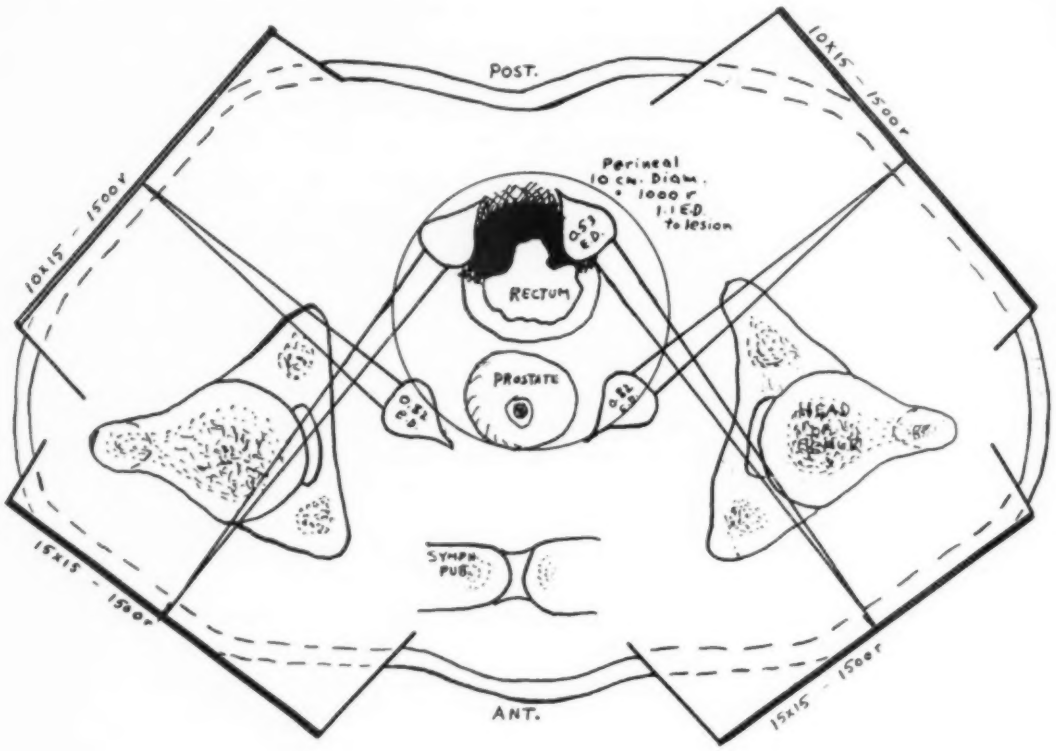

FIG. 1. Case 1. Tranverse section through rectal growth. Point of "spear" indicates a plane, normal to the axis of the beam, in which the dose is the value indicated in the spearhead. Roentgen-ray factors = 200 kv. (peak), Thoraeus filter equivalent 2 mm. Cu, 80 cm. skin target distance, half-value layer = 1.9 mm. Cu. (See Table 1 for summary of tumor dose for this case.)

Grinnell[8] on the basis of glandular arrangement, invasiveness, nuclear polarity, and number of mitoses. However, by the use of irradiation for many in the Grade 2 and 3 groups, the results may not be as discouraging as Grinnell has stated, where surgery was used alone. The radiosensitive growths demonstrated different grades of activity, the radiosensitive tumors were in Grades 3 and 4, while the less sensitive ones were Grades 1 or 2. Stewart and Spies[17] divided a large series of patients with cancer of the rectum into four pathological groups and concluded that a microscopical analysis was valuable for the type of treatment and prognosis of the individual patient. The Grade 4 group might well be omitted, since only one patient was placed in this group by several pathologists. The grading used coincided with the criteria established by responded well to curative as well as palliative irradiation.

Treatments were begun with high voltage roentgen rays with the following factors: 200 kv., 15 ma., 80 cm. distance, Thoraeus filter equivalent to 2.0 mm. copper and a half-value layer of 1.9 mm. copper. All doses were based on measurements in air. Four portals were employed, two anterior with 15×15 cm. field, and two posterolateral with 15×10 cm. field, and for growths situated low in the rectum, a perineal 10 cm. diameter field (Fig. 1).

A tumor dose of 1.64 erythemas was delivered through the posterior portals (2) and 1.06 erythemas through the anterior portals (2), or a total of 2.7 erythemas by roentgen irradiation. For growths in the lower half of the rectum an additional erythema was delivered into the tumor through the perineal portal.

Posterolateral fields rather than straight posterior fields were used because of the danger of missing the growth and the risk of over-irradiating the skin in the gluteal fold. Daily or alternate-day treatments of 300 r to one field were given to all patients, until approximately 900 r was delivered to each field. A clinical impression was easily made on the sensitivity of the growth from this therapeutic test.

If response was noted in the palliative group, the treatments were continued as outlined, until 1,500 to 1,800 r was delivered over each of the portals. If the reverse was true, or the patient did not tolerate the irradiation, the treatments were given less frequently for a dose of 1,200 to 1,500 r over each portal. In other words, the treatment was symptomatic in the less favorable group with the prospect of repeating the treatments for recurrent symptoms. The external irradiation in no instance altered the status of any of the patients in the palliative group. Case 1 was the single exception, and the patient is well after moderate doses of roentgen radiation. Bowing and Fricke[4] advocated preliminary irradiation for all advanced tumors because many of the borderline cases became operable.

TABLE I

TUMOR DOSE OF ROENTGEN RADIATION FOR CASE 1

Date (From)	Portal	Field Size cm.	In Air (r)	On Surface (r)	On Surface (S.E.D.)	Depth in cm.	Percentage Depth Dose at this Depth (80 cm. skin target distance)	r to Tumor	S.E.D. to Tumor
9. 9.36	lt. lat.	10 x 15	1200	1550	2.6	17	21	325	0.54
	lt. post. lat.	10 x 15	1200	1550	2.6	15	25	390	0.65
10. 7.36	lt. lat.	10 x 15	900	1150	1.9	17	21	240	0.40
	lt. post. lat.	10 x 15	900	1150	1.9	15	25	290	0.48
	ant.	10 x 15	600	770	1.3	20	13	100	0.17
12. 7.36	lt. post. lat.	10 x 15	1500	1950	3.2	15	25	490	0.82
	rt. tang. abdom.	10 x 15	1500	1950	3.2	17	21	410	0.68
11. 8.37	rt. tang. abdom.	10 x 15	600	770	1.3	17	21	160	0.27
	lt. post. lat.	10 x 15	600	770	1.3	15	25	190	0.32
6.25.38	lt. suprapubic	10 x 15	900	1150	1.9	15	25	290	0.48
7.12.39	rt. ant. abdom.	10 x 15	1500	1950	3.2	20	13	250	0.42
	lt. ant. abdom.	10 x 15	1500	1950	3.2	20	13	250	0.42

Palliative therapy was given 15 patients or approximately 50 per cent of the group The decision to give this type of treatment was based upon extensive invasion of the primary growth in the surrounding tissues of the rectum in all patients, abdominal masses or liver enlargement from probable metastases in 7 patients, poor general condition with marked loss of weight in 5, advanced cardiovascular disease in 2, and one patient had an extensive recurrent carcinoma in the perineum following radical surgery. Justification for the use of palliative therapy only in this group is the fact that during the first three months after the original examination 5 of the patients died, and during the first two years, 9 patients. By treating this group, a degree of pallia-

tive symptomatic relief was given all of the patients, and the followng case, W. H. R., received an excellent result, since he is well and without symptoms four years after the initial irradiation.

Case 1. W. H. R. white, male, aged fifty-nine, carpenter. Chief complaint blood in stools. In August, 1935, blood and mucus were first noticed in the stools. These findings became constant, and during the past month the abdomen became distended from excessive gas formation and crampy pains were severe. Constipation increased, with alternating diarrhea at times, and the patient lost 20 pounds during the preceding year.

On examination of the abdomen, a mass was palpable 6.0 to 8.0 cm. in diameter in the left lower quadrant, which was slightly fixed. No other masses were palpable. On proctoscopic examination, the instrument was passed 18 cm. when the tip encountered the mass, but the bowel could not be straightened sufficiently to expose the ulceration. An exploratory laparotomy was performed, and the primary growth was sufficiently movable for resection except for indurated nodes in the mesentery and one 2.0 cm. in diameter along the aorta. A colostomy was performed with the distal loop taut for possible interstitial irradiation later.

Pathological diagnosis: Adenocarcinoma, Grade 2.

Roentgen radiation was delivered in a series of cycles with the previously mentioned factors (Table 1). From September 9, 1936, the lateral and posterolateral abdominal 10×15 cm. portals received 1,200 r each in twelve days. From October 7, 1936, the lateral and posterolateral portals received 900 r each, and now that the colostomy wound was completely healed, an anterior portal the same size was given 300 r. This cycle was given in eighteen days. By December, 1936, the patient had gained 21 pounds and had regained most of his strength. The tumor in the abdomen was no longer palpable. From December 7, 1936, the posterolateral and a new right tangential abdominal portal were given 1,500 r each in twenty-one days. One year later, in November, 1937, a mass was palpable about 4.0 cm. in diameter, and the patient was in excellent general condition without loss of weight. From November 8, the right abdominal and posterolateral portals received 600 r in six days. In June, 1938, a left suprapubic portal below the colostomy received 300 r on three successive days. A year later in July, 1939, the patient was in excellent general condition with no loss of weight or strength, and there was no evidence of disease nearly four years after the initial treatment.

Roentgen irradiation was given in the favorable group (13 patients) not only for the therapeutic test, but also as a preradium treatment. If regression was marked, the roentgen treatments were continued until 1,800 to 2,000 r was delivered over each of the pelvic portals, and 1,000 to 1,200 r to the perineal portal. In the majority of cases, however, the external irradiation was interrupted because the response was not sufficient to warrant delaying the interstitial irradiation. Following the radium therapy, the roentgen-ray cycle was resumed and continued to the limit of skin tolerance.

INTRARECTAL RADIATION

The use of sources of radiation in a growth itself was the first step in the curative treatment of cancer within the body. Bare glass radon tubes were first applied to rectal tumors by Quick,[13] and Kelly and Ward.[10] Knowledge of the effectiveness and more uniform dosage with gamma radiation has brought about a transition to greater filtration with the various heavy metals to eliminate all beta rays. Binkley[2] and many others have used these gold filtered radon seeds since they were devised by Failla. The concept and determination of the lethal tumor dose (Martin, Quimby and Pack)[11] made it possible for many therapists to destroy even rectal cancers, although recovery in such cases was generally considered unusual. Reliance on interstitial radon seed irradiation for the main dose of large rectal growths frequently caused chronic radiation ulcers, and many times healing was greatly delayed, and sometimes never occurred. Overdosage seemed as serious as underdosage when using roentgen radiation or interstitial implants alone as curative treatment. The reaction of epithelial and tumor cells to more prolonged irradiation was

described by Ewing[6] according to his theory of adaptation:

> The normal epithelium acquires a resistance to the rays by the process of adaptation, and is able to regenerate under a dosage which originally destroyed the pre-existing epithelium. At the same time the tumor cells, subjected to exactly the same dosage do not exhibit that power of adaptation and regeneration but perish, and in this respect they differ from normal cells. Upon this difference the cure of the cancer seems to depend, for the normal epithelium may regenerate and the cancer cells do not.

Accordingly, the narrow margin, or safety zone, of roentgen radiation dosage was widened for more practical use in the rectum, not only by the divided dose technique and multiple portals, but in combination with interstitial radon seeds and perirectal radium needles for a large portion of the tumor dose. Thus, all but the tumor tissue was spared overdosage, and regenerative powers of irradiated normal tissue were preserved.

The preliminary roentgen therapy was completed to the limit of skin tolerance (1,800 to 2,000 r) on all of the radiosensitive cases. Frequent proctoscopic examinations were an invaluable aid to familiarize the operating therapist with the situation for the subsequent interstitial implantation, and surprising regression was noted several times. However, many of the growths showed little or no response to roentgen irradiation, and the treatments were interrupted so that interstitial irradiation could be administered to avoid further activity. The earlier patients were treated by the insertion of radon seeds through the proctoscope in the office or dispensary without anesthesia. With spinal anesthesia the procedure may be performed painlessly with relaxation and complete exposure for accurate and uniform implantation.

A large operative proctoscope with direct lighting at the tip was used for the widest exposure when possible, but frequently a narrow-gauge proctoscope was necessary in order to pass a tumor stricture. A plan for dividing the seeds uniformly was necessary, since over twenty seeds were implanted into the majority of the patients. A mental division of the tumor volume will do, or the trocars carrying the seeds may be left in place for landmarks while a quarter or a half of the growth is treated at a time. Whenever possible, a visualization of the growth in a number of spheres will not only aid in the placement of the seeds, but in the calculation of the dose of radiation. The number and location of the seeds were determined for the delivery of 7 or 8 erythema doses of radiation uniformly throughout the tumor. Ideally, for the average case, the seeds were implanted in the zone between the middle and outer third of the growth, as shown in Figure 3. The dosage from interstitial radiation may be calculated in erythemas, but this treatment should not be added to the erythema dose delivered by roentgen radiation without mentioning the duration of the roentgen therapy, the interval between it and the insertion of the radon seeds, and the recovery rate of the growth.

An attempt should be made to leave the seeds in firm tumor tissue or superficial muscle layer to diminish the risk of their becoming dislodged. When relying solely upon radon seeds for the interstitial treatment, most therapists implant a 20 per cent greater dose than they believe is required, because of the uncertainty of delivering the calculated radiation. Recently Sharp and Pugh[15] demonstrated that an abnormal or inadequate response to interstitial irradiation may be due to the immediate or early loss of seeds from the growth. A method of detecting this loss of emanation was described, using a fountain-pen type electroscope for daily measurements over the sacrum. One case was reported of the loss of nine of the ten seeds during the first twenty-four hours from a growth at the rectosigmoid juncture. This check by intensity measurements is the only way of being certain of the dose delivered by interstitial tumor irradiation with nonremovable seeds.

Other difficulties were encountered, such

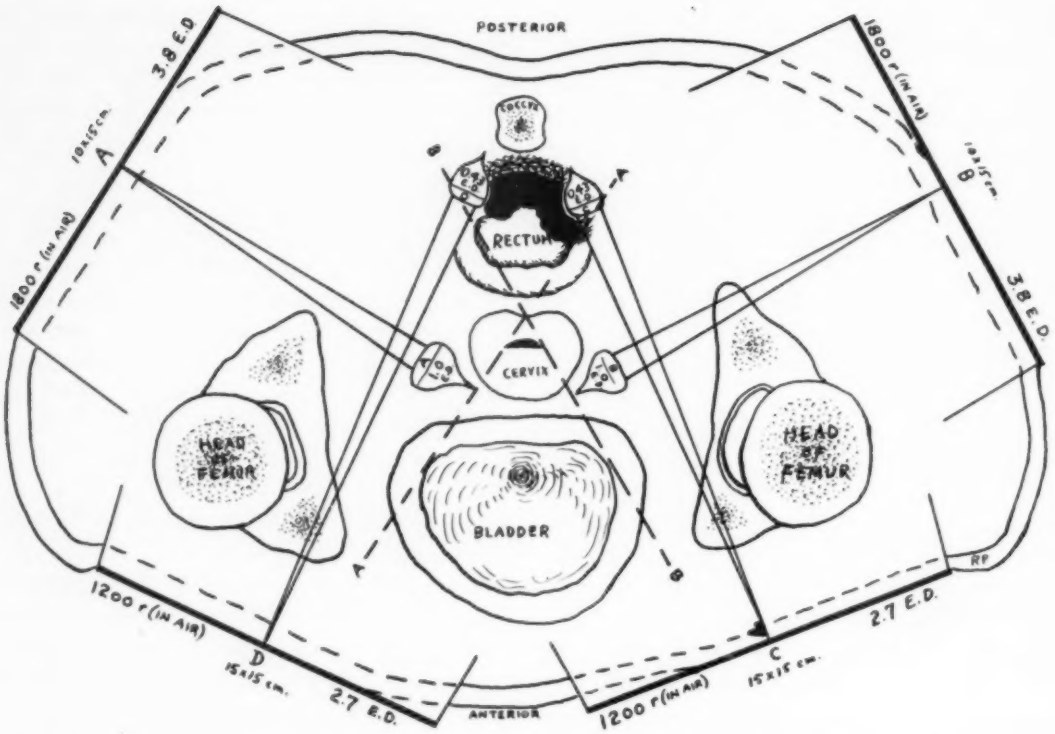

FIG. 2. Case II. Transverse section through rectal growth. Point of "spear" indicates a plane, normal to the axis of the beam, in which the dose is the value indicated in the spearhead. Roentgen-ray factors = 200 kv. (peak), Thoraeus filter equivalent 2 mm. Cu, 80 cm. skin target distance, half-value layer = 1.9 mm. Cu. (See Table II for summary of tumor dose for this case.)

TABLE II

TUMOR DOSE FOR CASE II

Date (From)	Portal	Field Size cm.	In Air (r)	On Surface (r)	On Surface (S.E.D.)	Depth in cm.	Percentage Depth Dose at this Depth (80 cm. skin target distance)	r to Tumor	S.E.D. to Tumor
Roentgen Radiation									
12.21.35	post. lat.	10 x 15	1800	2300	3.8	15	25	580	1.0
	post. lat.	10 x 15	1800	2300	3.8	15	25	580	1.0
	ant.	15 x 15	1200	1600	2.7	20	16	260	0.43
	ant.	15 x 15	1200	1600	2.7	20	16	260	0.43
							Tumor dose by roentgen radiation		2.8
Radon Seeds									
1.25.36	Dimensions of growth 3.5 cm. diameter		19.2 mc-destroyed						
							Tumor dose by radon seeds		8.0
							Total tumor dose		10.8

as an obstruction of the lumen or a stenosis due to invasive tumor with an indeterminate amount of tumor tissue above. The implantations were performed under spinal anesthesia and mechanical difficulties were overcome by using electrosurgical procedures for growths in the lower half of the rectum.

Case II illustrates an ideal problem of irradiation for a cancer of the rectum with an excellent result. The growth was considered operable, but the patient refused surgery.

Case II. E.U.H., white, female, aged seventy-three, housewife. Chief complaint rectal bleeding. In June, 1935, blood was first noticed in the stools and it persisted with mucus. Caliber of stools had not changed and constipation or crampy pains in abdomen had not occurred.

On examination, an indurated growth was palpated 3.5 cm. above the internal sphincter on the posterior and left wall of the rectum. The full thickness of the wall was involved; fascia and muscle were invaded, but the growth was movable over the coccyx. On proctoscopic examination, the growth measured 3.5 cm. in diameter.

Pathological diagnosis: Adenocarcinoma, Grade 2.

From December 21, 1935, to January 20, 1936, preliminary 200 kv. roentgen therapy was given, 1,200 r over each of the anterior pelvic portals and 1,800 r over the two posterolateral pelvic portals. The factors were the same as previously described. On January 25, 1936, sixteen radon seeds were implanted through the proctoscope in the zone between the middle and outer third of the growth. The seeds for this intrarectal treatment contained 1.2 mc. each, or a total of 19.2 mc., or approximately 2,500 mc-hr. (Fig. 2).

The radiation reaction was intense and persisted through February and March. In April, 1936, a second series of roentgen irradiation was prescribed with the same factors, and 900 r was given over each of the posterolateral pelvic portals (Table II).

The scar remained quite thin and easily irritated, but otherwise the patient remained symptomless.

In August, 1939, the patient died from pneumonia. The complete postmortem examination failed to show any gross or microscopic evidence of disease in the original scar or metastases elsewhere in the body. Slight irradiation fibrosis was present in the tissues of the pelvis.

The irradiation from radon seeds implanted in the tumor for practical purposes was limited to the growth, and the surrounding mucosa received little from this dose unless the growth was bulky or annular. When large doses were employed, the margin of safety was narrow and the mucous membrane was frequently damaged and resulted in an indolent inflammatory mass. Case III was given a heavy dose of radiation for a moderately advanced growth in the ampulla of the rectum. The interstitial treatment appeared to accelerate activity, although subsequent biopsies failed to show tumor cells. In spite of this, the rectum was removed, and extensive histologic study of the tissues failed to show evidence of cancer.

Case III. H. A. R., white, male, aged fifty-two, physician. Chief complaint rectal bleeding. In December, 1935, blood was first noticed in the stools. At first it was intermittent, but recently it had been noticed daily. Mucus was present for two months, but the caliber of the stool had not changed.

On rectal examination, an indurated growth was palpated 2.0 cm. above the internal sphincter on the posterior wall, and the impression was gained that it invaded muscle but not extensively. On proctoscopic examination, the growth was found to be ulcerated with a superficial central crater which measured 4.0×3.5×1.0 cm.

Pathological diagnosis: Adenocarcinoma, Grade 2.

From July 20 to August 10, 1936, 200 kv. roentgen therapy was given with the previously mentioned factors. Three 10 cm. circular portals were taken, two gluteal and a sacral, and the skin was marked to avoid overlapping. Two areas were given 150 r daily until the gluteal portals received 1,800 r each, and the sacral portal 1,500 r. On August 12, 1936, sixteen radon seeds were implanted in the zone between the middle and outer third of the growth through a proctoscope. The seeds for this intrarectal treatment contained 1.5 mc. each, or a total of 24.0 mc., or approximately 3,200 mc-hr. (Fig. 3).

Fig. 3. Case III. Sagittal section through rectal growth. Diagrammatic sketch of the location of radon seeds in the zone between the middle and outer thirds of the growth.

The irradiation reaction was intense, and one month after the interstitial implantation, a mass was present at the site of the primary growth at least 4.0 cm. in diameter. The consistency was spongy and it had an inflammatory appearance. From September 25 to 30, roentgen therapy was given in an effort to reduce the inflammation. With the same factors 300 r was given over alternate gluteal portals on four successive days, or a total of 600 r to each (Table III).

The patient became quite apprehensive with the persistence of the inflammatory mass, and in October, 1936, three biopsies were taken over the mass, and the microscopic examination failed to show evidence of cancer. In spite of this, a resection was performed elsewhere, and minute microscopic studies of the entire area failed to show evidence of cancer.

The patient has remained well, with no evidences of local recurrence or metastases after nearly four years.

Intrarectal surface radium applicators were constructed specially for different areas in the rectum by Binkley[3] and others. A considerable amount of radium is required for a minimum treatment time to assure exact application during the exposure. Unless such a treatment is accurately applied, the adjacent mucous membrane receives the same tumor dose. This procedure was used on 5 of the advanced patients with very little benefit.

PERIRECTAL RADIATION

In 1934 a division of the interstitial radiation dosage between the radon seed implantation and perirectal radium needles was instituted. The division of this dosage has apparently been satisfactory and appeared to be due to: (1) radiation sources both within and surrounding the tumor mass; (2) long uniform sources limit the depth dose from the needles for a given

Table III

TUMOR DOSE FOR CASE III

Date (From)	Portal	Field Size cm.	In Air (r)	On Surface (r)	(S.E.D.)	Depth in cm.	Percentage Depth Dose at this Depth (50 cm. skin target distance)	r to Tumor	S.E.D. to Tumor
7.20.36	rt. gluteal	10 diam.	1800	2250	3.75	8	41	920	1.55
	lt. gluteal	10 diam.	1800	2250	3.75	8	41	920	1.55
	sacral	10 diam.	1500	1850	3.1	5	60	1100	1.85
8.12.36	Intrarectal radon seed implantation into tumor—24.0 mc. (diameter considered 4.0 cm.)								8.3
9.25.36	rt. gluteal	10 diam.	600	750	1.25	8	41	310	0.52
	lt. gluteal	10 diam.	600	750	1.25	8	41	310	0.52

milligram-hour dose; (3) certainty of the delivery of the planned dose as contrasted with the possibility of loss of seeds; (4) serial application rather than single caustic dose; (5) avoidance of local necrosis and post-irradiation indolent ulcers due to division of dosage; (6) the added filtration of the needles completely eliminated beta rays; (7) less contracture of the lumen; (8) less pain from the combined irradiation. Naturally, a larger total interstitial dosage was given by the combined intra- and extra-interstitial procedure, and yet the immediate and late effect on the rectal mucosa did not seem as great. This minor surgical procedure has been employed for six years only, but sufficient time has elapsed to encourage us to use this perirectal irradiation for all growths where a cure was attempted.

Neuman and Coryn[12] advocated a wide perirectal exposure with resection of the coccyx and possibly a part of the sacrum. The rectum was exposed by means of blunt dissection along the entire extent of the tumor. Implantation of radium needles was easy in and around the tumor for a homogeneous dosage to their satisfaction. Even the lymph nodes were located and implanted. Gordon-Watson[7] employed the open operation for radium implantation, and his entire dosage was given by this method in most of his patients. Berven[2] and Shedden[16] implanted radon seeds in and around the growth for the most uniform and homogeneous irradiation. In our experience, an extensive exposure was unnecessary for the perirectal radium needles. The insertion of needles in trocars through stab wounds in the perineum was an important adjunct to the radon seeds in the growth itself for obtaining a uniform dose in and around the tumor.

The surgical procedure for perirectal irradiation was performed under spinal anesthesia with the patient in lithotomy position. The perineum was prepared as for any surgery in this area. Stab incisions were made 1.0 cm. away from the mucocutaneous junction and directly out from

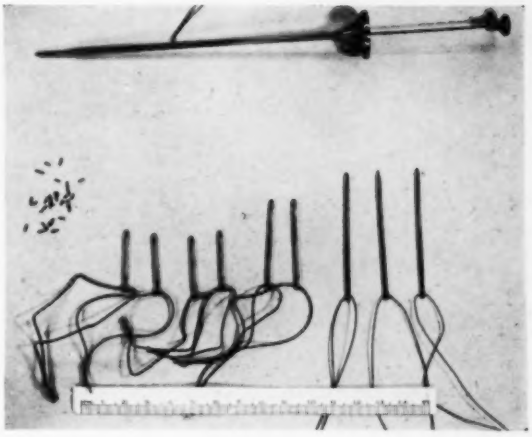

Fig. 4. Equipment for intrarectal and perirectal interstitial irradiation.

the growth. Sufficient incisions were made for inserting the necessary needles, two or three needles in each. If the growth involved only the posterior wall, the skin wounds were all posterior to the anus, while if one-half or more of the circumference of the rectum was involved, the skin punctures covered a corresponding area around the anus. The left index finger was inserted in the rectum to serve as a guide, and the needles were inserted with a trocar systematically from one margin to the other. They were placed within 1.0 cm. of the base of the growth, and a short or larger needle was used according to the dimensions of the growth. The needles were placed parallel to one another and 1.0 cm. apart. The silk threads were sutured to the skin.

Growths with an upper margin of about 15 cm. above the external sphincter have been treated by this method, and we believed as accurately as those lower in the rectum. When above the directing finger, a small proctoscope may be used satisfactorily for the placement of the needles. Needles were planted in the prostate without complications. Only in one patient a transurethral resection was performed, but the indications were present before the treatment. Needles were planted in the hollow of the sacrum with an equal degree of accuracy. In certain female patients the

Fig. 5. Case iv. Sagittal section through rectal growth. Diagrammatic sketch of the location of radium needles after insertion through perirectal stab wounds.

needles were implanted in the rectovaginal septum into the base of the growth.

The equipment consisted of the following radium sheaths: six with one 2.0 mg. cell, four with two 2.0 mg. cells in tandem, and four with four 2.0 mg. cells in series. A trocar was used with a suitable internal diameter to accommodate the sheath with stout silk thread attached. Radium sheaths were used with 0.3 mm. platinum filtration, and the needles themselves had 0.2 mm. platinum walls, giving a total of 0.5 mm. platinum. The sheath needles contained one, two, and four 2.0 mg. small radium cells, and their active lengths were 1.8, 3.0, 5.0 cm., and the total lengths 2.7, 4.0, and 6.0 cm. respectively (Fig. 4).

Cade[9] advocated a filter of 0.6 to 0.8 mm. of platinum as an added precaution against necrosis, with the irradiation time correspondingly increased.

The calculation for the combined treatment must be an individual tumor problem. An attempt was made to deliver 3 erythema doses into the growth by roentgen irradiation. During or following this treatment from 3 to 4 erythema doses were delivered by radon seeds into the growth. The remainder of the estimated dosage of 3 or 4 s.e.d. was supplemented at the time, or preferably two to four weeks later, with perirectal needles. An attempt was made to divide the total dosage into the tumor equally between roentgen irradiation, intrarectal radon seeds, and perirectal radium needles. The total dosage can only serve as an indication or guide, since it does not take into account recovery rate nor the duration of the cycle.

Case iv. J. V., white, female, aged sixty-four, single. Chief complaint blood and mucus in stools. In September, 1935, blood was noticed in the stools, at first intermittent, but then present continuously with mucus. Defecation became painful, but the caliber of the stools remained the same. Pain radiated down the legs at times, and the patient lost 12 to 15 pounds in weight.

On rectal examination, an indurated growth was palpable on the posterior and right wall of the ampulla of the rectum. The lower margin involved the internal sphincter. The dimensions were 4.0×4.0 cm., and it infiltrated the surrounding tissues at least 2.0 cm. On proctoscopic examination, the growth appeared ulcerated with a central crater.

Pathological diagnosis: Adenocarcinoma, Grade 2.

From October 2 to 30, 1936, 200 kv. roentgen therapy was given with the previously mentioned factors. The two anterior pelvic portals received 1,800 r, and the two posterolateral portals 1,500 r, and the 7.0 cm. perineal circular portal, 600 r. On November 1, 1936, under spinal anesthesia, two platinum sheath needles containing two 2.0 mg. radium cells in tandem and four sheaths containing one 2.0 mg. radium cell each were implanted through three stab wounds in the perineum (Fig. 5). The measurements of the needles are described elsewhere in the paper. The needles were placed in the base of the growth and equidistant from each other by inserting the index finger in the rectum as a guide. The strings were stitched to the skin and the needles left in place for five and one-half days, or a total dose of approximately 2,000 mg-hr. for this perirectal irradiation (Table iv). The sphincter was cut twice because of the growth invasion into it.

The reaction was intense but not painful, and complete healing occurred in three months. The patient has gained 25 pounds in weight and is in excellent condition three and one-half years after treatment. The anus is not sensitive, although care of the paralyzed sphincter is required.

The reaction from the combined roentgen irradiation, intrarectal and perirectal procedures was intense, with a bright erythema over the skin of the pelvis and perineum and a mucositis throughout the rectum. The growth usually enlarged immediately after interstitial implantation (Case III) from inflammation, and it was acutely tender, but gross infection and abscess did not occur in any of the patients. This acute inflammatory reaction occurred in the successfully treated cases and some reaction persisted for eight to twelve weeks. The symptoms from such a reaction were easily controlled with oil retention enemas, soothing suppositories, and mild narcotics such as codeine and aspirin.

Colostomy was only performed on 4 out of the 28 patients, 2 of the patients as the preliminary step in the treatment of advanced cancer, the third was performed for obstructive symptoms, and the fourth colostomy was performed after the irradiation of an adenocarcinoma involving the anus, for relief of irritation and pain. Of the 4 patients with colostomies, 2 died from cancer, one after eighteen months and one after eight years. The third patient is clinically free of disease, and the fourth died of intercurrent disease and the postmortem did not show evidence of disease locally or metastases elsewhere in the body. The remaining 11 patients who received aggressive treatment, and all of the palliative group (15 patients) were treated throughout without colostomy. In Case IV the growth involved the internal sphincter, and at the time of the perirectal implantation the sphincter muscle was divided twice for relief from spasm and pain.

TABLE IV

TUMOR DOSE FOR CASE IV

Date (From)	Portal	Field Size cm.	In Air (r)	On Surface (r)	(S.E.D.)	Depth in cm.	Percentage Depth Dose at this Depth (80 cm. skin target distance)	r to Tumor	S.E.D. to Tumor
10.2.36	lt. ant.	15 x 15	1800	2400	4.0	20	16	385	0.64
	rt. ant.	15 x 15	1800	2400	4.0	20	16	385	0.64
	lt. post. lat.	10 x 15	1500	1950	3.25	15	25	490	0.82
	rt. post. lat.	10 x 15	1500	1950	3.25	15	25	490	0.82
	perineal	7 cm. diam.	600	720	1.2	5	54 (50 cm. S.T.D.)	390	0.65
Perirectal interstitial radium needle dose—2000 mg-hr. (diameter considered 4.0 cm.)									4.0
							Total tumor dose by roentgen radiation and perirectal radium needles		7.57

SUMMARY

The eradication of the growth by irradiation methods was attempted in 13 patients out of 28 who were followed from four to eight years. This group received high voltage roentgen therapy to skin tolerance, radon seed implantation, and in most patients the intratumor implantation was combined with removable perirectal radium needles. The total radiation dosage was calculated in advance and was divided, with few exceptions, into thirds for the

three methods of application. Of the 13 patients receiving this treatment 7 (approximately 50 per cent) are free of disease, or postmortem examination failed to disclose evidence of disease. Two additional patients are living with disease five and eight years respectively. The remaining 4 patients died from disease.

Palliative therapy was given approximately 50 per cent of the series, and this corresponds roughly with the reports of Bowing and Fricke,[4] Binkley,[3] Shedden,[16] and Berven.[2] The treatment was primarily roentgen irradiation, and it seemed particularly satisfactory for symptomatic relief. The primary growth was frequently held in check until metastatic lesions elsewhere in the body produced fatal complications. The patients in this group lived from one to thirty months, except for Case 1, who is living and well after four years.

CONCLUSIONS

1. A therapeutic test dose of roentgen radiation was a definite guide for the subsequent course of treatment on all patients.

2. By the combination of roentgen irradiation, intrarectal radon seeds, and perirectal radium needles, a lethal dose of radiation was delivered into the growth with minimum effect in the surrounding normal tissues.

3. The division of the interstitial radiation was satisfactory and appeared due to:
   a. Radium sources both within and surrounding the tumor mass.
   b. Long uniform sources limit the depth dose from the needles.
   c. Certainty of the delivery of the planned dose as contrasted with the possibility of loss of radon seeds.
   d. Serial application rather than a single caustic dose.
   e. The added filtration of the needles completely eliminates the beta rays.
   f. Less contracture of the lumen and pain from the combined interstitial irradiation.

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DISCUSSION

Dr. M. Elizabeth Howe, New York City: Dr. Binkley was to discuss this paper but he is out of town and I was asked this morning to discuss it for him. I think he would be interested in another method of using radium. His feeling about most of his own cases is that no case can be cured by irradiation which cannot be cured by surgery. Irradiation, as he uses it, is primarily a palliative measure. He doesn't feel, as a rule, that any case can be prolonged, as far as its duration of life is concerned, by any form of irradiation which we have used so far. The patient is made more comfortable, possibly.

In the treatment of his cases I would like to ask Dr. Sharp whether he ordinarily carries his external irradiation up to the limit of tolerance. That is one thing which we very rarely do. We use roentgen irradiation primarily to reduce the amount of infection and possibly to define the extent of the lesion and to determine its operability.

The other question I wanted to ask him was what the individual dosage in seeds was that he used in his interstitial therapy. We rarely have any necrosis following interstitial irradiation by this method, using very small strengths of individual seeds; also using them in multiple dosage.

In our cases, as in most of those that Dr. Sharp has described, we rarely rely on one method of irradiation and we are interested in having another method to add to the ones that we are using now.

For Dr. Binkley's cases, as he has described several times, he is using external therapy to take care of the infection and to define the lesion. On the cases that are superficial and small and prove to be radiosensitive, he is using the rectal applicators which he has described before this Society.

In addition, he may also employ interstitial irradiation, using a very small strength of seed, usually not to exceed 0.5 to 0.7 mc. per seed.

In a few cases we are trying perirectal irradiation with doses of small seeds implanted through the perineum, which would have the single advantage over Dr. Sharp's procedure of not having to take out the radium implants later.

This is an excellent paper. If we could benefit 50 per cent of the operable cases treated by any method, we would be extremely happy.

Dr. Henry J. Ulmann, Santa Barbara, Calif. Dr. Sharp, were your cases all inoperable, or were some operable?

Dr. Sharp: Of the patients observed over four years, 50 per cent were so-called operable and 50 per cent advanced.

Dr. Ulmann: Did you divide those operable and inoperable cases, the percentage of cures, into two groups?

Dr. Sharp: Of the 13 so-called operable cases, 7 are free of disease, or postmortem examination failed to disclose evidence of disease. Fifteen patients were advanced, and they lived from one to thirty months except one, who is living and well.

RADIATION TREATMENT OF HEMANGIOMA*

By JACK SPENCER, M.D.
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THE method of treatment of cavernous hemangiomata of the skin and subcutaneous tissues in children is variable, depending upon the size, location, and more especially on the physician or clinic at which the patient is treated. The available methods for treatment are excision, electrocoagulation, injection of sclerosing solutions, carbon dioxide snow, roentgen rays and radium (radon) either interstitially, by contact, or at a distance. There is considerable variation in the technique and dose when radium is used.

Consideration is given to those cases which develop a small port-wine vascular compressible tumor shortly after birth, involving the skin and subcutaneous tissue, with a gradual increase in size from 0.2 to 8 cm. in diameter and with varying degrees of thickness. Histologically, the cavernous hemangioma consists of large blood spaces or sinuses lined with endothelial cells. Occasionally there is a rapid growth. On the other hand, there may be a spontaneous regression without any form of treatment. For this reason, we have found it desirable to wait until the patient is six months old before instituting treatment.

Figi strongly advocates the use of radium as the method of choice in treating these vascular tumors. Roesler reported a group of cases treated with filtered radium at 1 cm. distance, all showing excellent response to this type of treatment. Peyton and Leven reviewed the various methods in use in treating these lesions and reported better results with the use of radiation (roentgen rays or radium). They have found that those tumors failing to respond to irradiation can be successfully treated with injections of sodium morrhuate. Nielsen reported 400 cases of angiomata treated with radium. Of these, 354 were of the cavernous type, and there were 90 per cent cures. The fundamental principle of his technique was to employ suberythema doses and never to start on a new treatment before the preceding one had run its complete course, allowing intervals of two to four months at least. His results indicated that radium was superior to other methods in use. Newcomet also advocated the use of radium as the usual method of choice. Recent textbooks on radiation therapy advocate the use of radium.

Carbon dioxide snow is often used and injections of sclerosing solutions have been used with equal success.

This study comprises a series of cases treated with radiation at the Huntington Memorial Hospital since 1920. Although there has been considerable variation in the technique of treatment during this time, three groups of cases can be conveniently

TABLE I

CASES FOLLOWED SIX OR MORE YEARS AFTER RADIUM TREATMENT

No. of Radium Treatments	Observation Time (years)	Condition of Skin
1	17	No change
3	13	No change
12	13	Scar and telangiectasis
3	17	Scar
13	11	Scar and telangiectasis
6	16	Scar
14	15	Malignancy developed in scar in 1935
6	14	Scar
6	7	Pigmentation
5	12	Scar
1	6	Scar
1	6	Scar
1	7	Scar
8	9	Scar
13	8	Scar
3	14	Scar

* From the Collis P. Huntington Memorial Hospital, Boston, Massachusetts.

considered. The first group, treated from 1920 to 1930, is considered not so much for the technique of treatment, but with special reference to late skin changes. This group of cases was treated with filtered and unfiltered radium, given both in contact and at a distance.

The second group consists of 25 patients who were treated with radon filtered with 1.5 mm. of brass at 1 cm. distance. A single dose of from 200 to 300 mc-hr. was given, which is equivalent to about two-thirds of an erythema dose. The patients were seen at two to three months' intervals, and as long as there was continued regression of the vascular tumor or fading in color, no treatment was given. As soon as it was noted that no change was taking place, the treatment was repeated.

All of the 21 cases followed showed complete regression. Ten of these cases required only one treatment. One patient, with the entire right side of the face involved, received nine radium treatments and three roentgen treatments with an excellent result. The remaining 14 patients received two to three treatments at intervals of three or more months. The series of cases reported by Roesler were treated in this manner.

This technique has been conveniently employed, the source of the radon being the emanation plant at the Huntington Memorial Hospital. With the adequate supply of radon it has been possible to complete the treatment in two to three hours. There are few clinics which have sufficient radium element to carry out this type of treatment in a reasonable length of time.

During the application of the radiation, it is necessary to have someone in constant attendance to make sure that the capsules are not displaced. In the treatment of lesions about the face and neck, great care is necessary to make sure that the capsules do not come in contact with the skin. Accidents have occurred in these regions. I recently saw a patient to whom this had happened during treatment of a hemangioma on the buttocks, resulting in a third degree irradiation reaction on the normal side.

The irradiation technique in use since 1935 in the treatment of hemangiomata has been entirely with filtered high voltage roentgen rays. A flexible, shock-proof therapy unit has been used. The treatments were usually about 200 r. The factors were 200 kv., 20 cm. focal skin distance, and 0.5 mm. copper filter. The treatment time for 200 r, measured in air, is one minute eight seconds, which is very short. Often with such a short treatment time it has been helpful to wrap the restless child in a sheet or to have the mother hold the child during the treatment, which eliminates any difficulty in placement of the lesion with respect to the source of the radiation.

After an interval of two months, if there had been regression, further treatment was delayed. When no further change in the size, thickness, or color was noted, an additional treatment was given. The children were seen at regular intervals and were treated every two to three months as necessary.

Although the observation periods in this series of cases have been somewhat short, the immediate response of the lesions to the small doses of roentgen rays seems to justify the reporting of this technique and immediate results. There were 19 patients who had been followed, the period of observation varying from four months to over two years. The average age of the babies treated was six months. The location of the lesions treated was variable, and they varied from 1 to 7.5 cm. in diameter. No patient received more than five treatments.

A study of the results of the cases thus treated, even in so short a time, reveals that there has been complete regression of 7 lesions, and almost complete disappearance of 4 lesions; that is, the color and thickness have almost completely disappeared. The remaining 7 cases have shown continued regression. In only one case was no change observed. This case was followed two months, after which the patient was taken by the parents to another clinic where the

TABLE II

RESULTS IN CASES TREATED WITH HIGH VOLTAGE ROENTGEN RAYS

Case No.	Age	Location	Size	No. of Treatments	Dose per Treatment	Observation Time	Results
I	12 mo.	Cheek	2 cm.	3	150 r	4 mo.	Blanching
II	5 mo.	Labia	5 cm.	5	200 r	15 mo.	Complete regression
III	5 mo.	Face	2 cm.	2	250 r	19 mo.	Continued regression; no further treatment necessary
IV	2 mo.	Leg	3.5 cm.	3	200 r	16 mo.	Complete regression
V	4 mo.	Abdomen	4.5 cm.	4	200 r	15 mo.	Complete regression
VI	6 mo.	Abdomen	4 cm.	2	200 r	21 mo.	Complete regression
VII	4 mo.	Abdomen	2.5 cm. ulcerated	2	200 and 150 r	19 mo.	Central scar with peripheral patch of color
VIII	3 mo.	Abdomen	3 cm.	2	200 r	15 mo.	Excellent
IX	3 mo.	Chest	3 cm.	2	200 r	2 mo.	No change: treatment elsewhere by electrocoagulation
X	4 mo.	Cheek	1 cm.	5	200 r	12 mo.	Color and thickness considerably less
XI	2 mo.	Back	7.5 cm.	1	200 r	5 mo.	Ulcerated; improved with healing of ulceration
XII	5 mo.	Thigh	5 cm. ulcerated	2	200 r	5 mo.	Continued regression
XIII	7 mo.	Forehead	1 cm.	4	200 r	26 mo.	Continued regression with slight coloration left
XIV	2 mo.	Scalp	2 cm.	3	200 r	8 mo.	Blanching
XV	11 mo.	Forehead	3 cm.	2	200 and 100 r	6 mo.	Complete regression
XVI	11 mo.	Abdomen	2 cm.	1	200 r	6 mo.	Almost complete regression
XVII	5 mo.	Chest	1 cm.	2	200 r	11 mo.	Continued regression
XVIII	17 mo.	Thigh	5 cm.	2	200 r	7 mo.	Rapid disappearance
XIX	20 mo.	Forehead	2 cm.	2	200 r	8 mo.	Color and thickness regressing

lesion was treated with electrocoagulation. One of the largest lesions, located on the thigh and measuring over 5 cm. in diameter showed a very striking disappearance of the large thick, vascular tumor in two months. Although a second treatment was given in this case, the response had been extremely gratifying over a very short period of time.

The lesions should be observed very closely, as not infrequently ulceration develops, due to trauma, which is not related to treatment with these small doses of roentgen rays. There were 7 lesions in this series of 137 hemangiomata which ulcerated, all being located in an area likely to be traumatized (chin 1, vulva 1, abdomen 1, leg 3, back 1). This possibility should be explained to the parents, thus avoiding any difficulty.

DISCUSSION

A study of the distribution of the lesions reveals that out of 137 lesions, 85 (62 per cent) were located on the neck, face or scalp. This emphasizes the importance of obtaining the best possible cosmetic result.

In treating any relatively benign lesion in the young with radiation, it is important to give the minimum quantity which will destroy the lesion, as the dangers of late radiation changes must be considered. A number of cases have been followed up to seventeen years after treatment. One case

developed a malignant condition in the scar fifteen years after the first treatment, 2 developed telangiectasis, and 1 developed pigmentation. All of these cases were given considerably larger doses of radium than we now consider necessary.

We have felt that it is important always to check the intensity before treating each case. The physical measurements should be correlated with the biological effects before using the roentgen-ray apparatus for treating any benign lesion, particularly lesions about the face. The technique in use at the present time delivers the minimal quantity of radiation to the vascular tumor and seems to be very effective without the danger of late skin changes. Larger doses will no doubt give a more noticeable immediate regression. Although originally only 200 r per treatment was given with good results, we now feel that it would probably be desirable to give as much as 300 r per treatment at first to some of the lesions and later give smaller doses, i.e. about 200 r, depending on the response.

The cases treated with radium in the early part of this series were given larger doses of radium than we now feel is necessary, and untoward reactions developed in a few of the cases. The danger of the child moving and the radium coming in contact with a normal skin area over such a long treatment time is also considered a disadvantage.

With the present technique, all of these objectionable features are eliminated. The patient can usually be treated at the first visit, the treatment time is short, and the dangers of the source of radiation intensity being altered are eliminated.

SUMMARY

The radiation treatment of 137 hemangiomata occurring in infants has been studied and is discussed in three groups: (1) those treated with large doses of radium and followed for six or more years after treatment; (2) those treated with small doses of filtered radium at 1 cm. distance; (3) those cases treated with high voltage roentgen rays.

The results in the treatment of the lesions with suberythema doses of filtered radium or filtered high voltage roentgen rays have been excellent and similar.

The use of high voltage roentgen rays is the more convenient method of irradiating this type of lesion.

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HYPERPARATHYROIDISM

ITS TREATMENT WITH ROENTGEN IRRADIATION

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THE syndrome of hyperparathyroidism stands as a mark of achievement in chemical and radiological contributions in this era of modern medicine. As a disease entity, it has been fully elucidated even to include methods of treatment.

In 1903, Erdheim[10] was the first to establish the relationship between the parathyroid glands and the metabolism of calcium and phosphorus in relation to the skeletal system. The association of a parathyroid tumor with multiple bone tumors was reported in 1908 by Kocher.[18] Strada[28] in 1909 cited the case of a woman, aged fifty-four, with osteomalacia and hyperplasia of the parathyroid glands. The initial reference to a relationship between a parathyroid tumor and osteitis fibrosa was given by Paltauf and Askanazy[24] in 1913. Two years later, in 1915, Schlagenhaufer[27] cited the instance of a man, aged forty-three, with advanced osteitis fibrosa and hypertrophy, rather than tumor, of the left parathyroid gland. Up to 1925, Hoffheinz[15] was able to collect from the literature the report of 45 cases of parathyroid enlargement in 25 of which there were skeletal changes, and in 17 of these osteitis fibrosa was present. Priority must be given to Mandl[21] of Vienna for his report of roentgenologic data secured before and after operation in a case of parathyroid tumor with consequent improvement. This was published in 1925. The following year an American report by DuBois appeared and later another by Hannon, Schorr, McClellan and DuBois.[14] Thereafter, the literature contained more numerous reports.[4,5,13,17,25,26]

PATHOLOGY

Hyperparathyroidism manifests itself as a clinical entity because of increased secretion of parathyroid hormone which results in a disturbed calcium and phosphorus metabolism. Excessive hormone liberation may be produced by a functioning adenoma or by hyperplasia of all the parathyroid tissue. In the series reported by Albright, Aub and Bauer,[1] 3 such instances of hyperplasia were encountered. The disturbed metabolism is expressed by an increased elimination in the urine of both calcium and phosphorus, and in the blood serum by an increase in the calcium and a decrease in the phosphorus content.

The consequence of such excretion of calcium and phosphorus is a depletion of these elements from their only storehouse, bone, which becomes decalcified. Increased urinary output may lead to urinary calculi. Albright[2] and his coworkers found calculi in 23 of 83 cases of hyperparathyroidism. There exists the possibility of the evolution of a anemia or leukopenia, as a result of fibrous tissue replacement in the marrow cavity with a diminution in the hemopoietic elements.

ETIOLOGY

Hyperparathyroidism occurs more commonly in females in the middle span of life. That there may be a hereditary tendency is emphasized by Ballin[3] who observed osteitis fibrosa cystica in three members of one family. In addition, a long standing diminished milk intake may be listed as a causative factor, but proof of this is still to be substantiated.

SYMPTOMATOLOGY

The symptoms may be conveniently classified as to the systems involved:

(1) *Due to Hypercalcemia.* Lassitude, muscular weakness, loss of weight, ano-

rexia, and constipation are general symptoms that will often be present, and the intensity frequently parallels the calcium level.

(2) *Due to Skeletal Involvement.* Bone pains, bone tenderness, or the appearance of a swelling due to an underlying cyst are the common early signs indicative of parathyroid activity. Not infrequently, the more serious complication of a pathological fracture at the site of a cyst may present itself as the first symptom.

(3) *Due to Changes in the Urine.* Polyuria and polydipsia are frequently concomitant with the symptoms enumerated above. Renal colic due to stone, when it appears, obviously overshadows all other symptoms. The possibility of its association with increased parathyroid activity must not be overlooked.

(4) A tumor of the neck may be palpable.

DIAGNOSIS

Since the disease is brought to the attention of the physician because of skeletal symptoms, a roentgen study of the bony structure will often yield the first clue to the diagnosis. Camp[6] and Camp and Ochsner[7] state that the fundamental change observed is a decalcification of the bone as a uniform miliary and granular mottling. That these findings become pathognomonic is their belief in stating "there is no other generalized lesion of bone which exactly simulates the miliary mottling and granular appearance of bone as in hyperparathyroidism." The decalcification is frequently associated with multiple cystic areas which may appear at the sites of most active growth, as in the metaphysis of the tubular bones. Single cysts may also be present, and a cortical cyst is very suggestive of a metabolic disturbance. Thinning of the cortex is common. The vertebrae may show a granular pattern. Pathologic fractures at the site of the cysts may occur.

If the roentgenologic evidence points towards hyperparathyroidism, confirmation depends upon the chemical findings. The disease is unique in that the serum calcium is elevated and the phosphorus is diminished. The normal level for these elements is a calcium of 9–11 mg., and phosphorus 3–4 mg. In addition, plasma phosphatase will usually be elevated above the normal level of a 2–4 Bodansky units. The phosphatase level is an index of osteoblastic activity, and in hyperparathyroidism, it is elevated in proportion to bone disease, and does not parallel the degree of parathyroid activity.

Of only minor importance in establishing the diagnosis will be a palpable tumor. According to Gutman, Swenson and Parsons,[12] a tumor in the neck may be palpated in about 10 per cent of the cases. In a series of 17 cases reviewed by Albright, Aub and Bauer only 2 patients had palpable tumors.

Sugar analysis of the blood and urine aids in distinguishing the polyuria and polydipsia from that due to diabetes.

Numerous skeletal changes may be confused with that of osteitis fibrosa cystica of hyperparathyroidism, and substantiating chemical findings only aid in differentiating such conditions. Among such conditions may be mentioned, senile osteoporosis, osteomalacia, solitary cysts, benign giant cell tumor, multiple myeloma, metastatic carcinoma and Paget's disease. Particularly, Paget's disease and the skeletal changes of hyperparathyroidism may appear in association with each other, as reported by Gutman and Parsons.[11]

TREATMENT

There have been described cases with complete spontaneous recovery.[20,29] Furthermore, some authors[11] report cases which showed evidences of remissions and exacerbations during the course of the disease. Their reports, however, do not definitely state whether the change was manifest in either or both the skeletal and chemical findings.

Various procedures have been tried in an attempt to control the progress of hyperparathyroidism. Hunter[16] reported the use without success of calcium and parathyroid extract. Albright, Aub and Bauer[1] used vitamin D, but without success. They were

of the opinion that the vitamin may increase the opportunity for kidney calculous formation.

Surgery. The indications for surgical interference in hyperparathyroidism are not well defined. Lahey and Haggart[19] have clearly elaborated upon the extreme difficulties and frequent failures that are encountered when surgery is attempted. Churchill and Cope[8] report similar experiences.

Failures of surgery may be due to several factors: first, there may be general hyperplasia rather than adenoma formation which is producing the excessive hormone secretion; secondly, the tumor may never be uncovered at an exploratory operation because of the extreme variations in size or more significantly because of the variations in position of the gland. Lahey and Haggart have convinced themselves of the tremendous variations in size of the non-adenomatous parathyroid gland, finding it to vary from that of a match head to that of a small lima bean. But, more puzzling than size is the location of the gland or adenoma. Parathyroids may be found along the mediastinum or in close proximity to the esophagus. Lahey makes a definite statement regarding this point: "We believe we can safely say that a parathyroid gland may be found at practically any position on, in, behind or below the thyroid gland," states Lahey, and he lists as the two most constant sites at which the glands are isolated (1) back of the thyroid gland, and (2) posterior lateral aspect of upper pole resting against laryngeal cartilage. Based upon such wide experiences, and frequent disappointments, Lahey has organized a systematic scheme of search for the parathyroid bodies.

Following surgical procedure when the gland can be isolated and excised, rapid metabolism responses are noted. Marked decrease in the urinary output of calcium and phosphorus may be determined within a period of several hours. It is worth mentioning at this time that tetany may develop if the blood calcium diminishes excessively below the level of 7 mg. The chemistry of the blood may approach the normal level within a period of one or two weeks. Bone pain and tenderness may all subside within several days. Only the roentgen changes occur slowly, and at monthly intervals examinations must be made before improvement becomes discernible on the roentgenogram.

Roentgen Irradiation. The first report of favorable results obtained by irradiation of the parathyroids was published by Merritt[22] in 1932. Treatment was administered to both sides of the neck with the following factors: 135 kv., 5 ma., 10 inch distance with 5 mm. Al filter, and given at intervals of about three weeks. Merritt did not state the total dose administered to his case.

In 1933, Dresser[9] reported observations on 5 cases, 2 of whom were irradiated. One had received 700 r to the neck and 600 r to the left shoulder and hip with high voltage roentgen therapy, with no resultant change in condition. The second patient received a total of 1,000 r, anteriorly and posteriorly, directly to the lesion over the hip, with mild relief of pain, but with rapid recurrence of symptoms.

In the 1934 report of Albright and his associates there is mention of the results of irradiation in 2 patients, although the technique and total dose administered are not given. They reported no beneficial effects as a result of this treatment. They felt that local treatment to the bone was without benefit because the cysts remained unaffected.

A second publication by Merritt and McPeak[23] in 1934 reiterated the fact that satisfactory results may be obtained with properly administered roentgen therapy. A total of 6 cases was reviewed including the one of the 1932 publication. The treatment plan recommended was the exposure of four areas: one over each side of the neck, one over the upper thorax anteriorly, and one over the neck posteriorly. The factors were 140 kv., 5 ma., 10×15 cm. fields, 6 mm. Al filter, and a dose of 240 r (measured in air) administered to each field. This dose was repeated in three weeks.

REPORT OF CASE

C. McC., male, aged twenty-one, was admitted to the Radiation Therapy Clinic of Bellevue Hospital in August, 1937, with the complaints of pain in the left hip and swelling of the right jaw, constipation and abdominal gas pains. Aside from an attack of pneumonia at the age of three years, there were no significant data in the past history. The onset of his illness in 1932 was five years prior to our observation, at which time he developed pain in the left thigh and weakness of the leg. This pain was most intense in the thigh but also radiated downwards to the knee and leg. Since the degree of discomfort was not great, the patient did not discontinue his school work. There occurred no great progression in the illness until three years later when pain and swelling appeared in the right lower jaw. A dentist extracted several teeth and curetted the bone beneath, and relief from pain ensued for a short while. Soon thereafter, however, the patient entered another hospital where, upon roentgen examination, a bone cyst in the left femur was discovered. No operative procedure was carried out and the patient was discharged. The patient remained symptom free, and in good health until November, 1936, when pain in the right jaw recurred. At this time he entered Bellevue Hospital.

Upon admittance in the Radiation Service, general examination revealed nothing of significance. Roentgenograms were again made of the skeleton and disclosed cystic areas in the left femur and right mandible. Aware of the suspicions aroused by the previous findings, metabolic studies were done at once. Soon after admission to the ward, the serum calcium was 13.3 mg. and phosphorus 2.4 mg. Phosphatase determination was found to be 24.9 units (Bodansky). One week later these studies were repeated and the calcium was 13.3 mg. and the phosphorus 5.5 mg. The phosphatase, in a second analysis, was 26 units. In January, 1937, although no tumefaction was palpable in the neck, exploratory operation was decided upon. A collar incision was made, and the thyroid gland was exposed by the usual thyroid technique. The lower and upper poles of the posterior aspect of the thyroid were dissected. No tumor was found. What appeared to be small parathyroid bodies were removed from both sides. Histologically, the excised material proved to be well preserved thyroid and parathyroid tissue.

FIG. 1. Roentgenogram taken at time of admission to the clinic (August, 1937). Shows a large cystic area involving the neck and greater trochanter of the left femur. There are many cysts of varying densities, all separated by thick trabeculae. No other such area appeared in any of the long bones.

Two weeks postoperatively, metabolic studies were repeated. The calcium was 14 mg., the phosphorus 3.7 mg., and a basal metabolic rate was +22 per cent. The blood chemistry was again done a fortnight later and the calcium was found to be 13.4 mg., phosphorus 3.2 mg. and phosphatase 21.8 units. Although the blood chemistry, one month after operation, showed no alteration or at least did not approach normal levels, the patient felt symptomatic relief, and was discharged from the hospital in February, 1937.

During the next few months, there occurred an insidious onset of pain in the left hip, slowly increasing in severity until August, 1937, when the patient returned to the Surgical Clinic and was then again referred to the Radiation Therapy Clinic. Upon admission to our clinic, roent-

Fig. 2. Roentgenogram of the right mandible taken on admission to the clinic (August, 1937). There are numerous small cystic areas covering most of the width of the bone.

gen examination disclosed in the neck and greater trochanter of the left femur a large area of decalcification in which there were two radiolucent cysts, and three denser cysts, all separated by thick trabeculae (Fig. 1). The remainder of the bones, even the long bones, did not exhibit any greater radiability. In the right mandible, there was a group of small cystic areas varying from 0.5 to 1.5 cm. in diameter (Fig. 2). There were no trabeculae traversing the cystic areas.

Roentgen treatment was instituted in September, 1937. The factors used were 200 kv., filtered through 0.5 mm. Cu and 1 mm. Al at 10 ma. At 50 cm. distance, with 6×8 cm. portals, treatments were directed at the right and left posterior thyroid areas in doses of 150 r (measured in air). Both sides were treated at one sitting until a total dose of 1,200 r was given. At the end of this series there was mild relief from pain in the left hip. The following month, with the pain again aggravated, the blood chemistry showed calcium of 11.8 mg. and phosphorus 1.2 mg. Accordingly, treatments were again instituted with the same factors to the same areas, and with individual doses of 150 r, a total of 1,500 r was given to each neck area. After one month, the patient reported a total absence of pain in the hip. Roentgen examination at this time revealed sclerotic changes in the cystic areas of the left femur. The trabeculae were thickened and the area appeared to be filling in with a bony network (Fig. 3). Metabolic studies showed a calcium of 9 mg. and phosphorus of 4.5 mg. Observations during the next months found the patient in satisfactory condition with no pain. Roentgen examinations at intervals gave evidences of slow but progressively increasing sclerosis in the hip.

In March, 1938, chemistry studies showed a calcium of 10.3 mg. and phosphorus of 2.8 mg. In May, 1938, recurrence of mild pain was reported, and high voltage roentgen treatments were again administered. A total dose of 1,200 r was again given with the same factors as previ-

Fig. 3. After a dose of 2,700 r to each parathyroid area given in two cycles. Evidences of increased sclerosis in the cystic areas are visible. The trabeculae have become more dense, and the cystic areas are filling in with a bony network. Pain is no longer experienced.

ously outlined. At the end of this series, the blood calcium was 12.6 mg., the phosphorus 3.2 mg., and the phosphatase, analyzed one month later, was 2.6 units. The last roentgenogram of October, 1938, disclosed dense sclerosis and almost complete filling in of the cystic defects previously observed (Fig. 4). The mandible, on the contrary, although showing decrease in the size of the cysts did not present any increased sclerotic changes (Fig. 5). Upon the last observation, there was no pain, discomfort, limping, constipation or any disturbances in general health. The total dose given to the parathyroid areas was 3,900 r to each side in three series.

DISCUSSION

A review of the history and developments in this case takes issue with some points in the diagnosis and treatment of this disease entity. Although several chemical analyses were obtained in which there existed a hypercalcemia and a hypophosphatemia, others did not vary much from the normal. Furthermore, after treatment, although the skeletal deformities showed satisfactory response, the blood levels did not maintain themselves normally. Merritt and McPeak state that there may be authentic cases of hyperparathyroidism without an elevation in calcium or a decrease in the phosphorus. Similarly, the phosphatase level per se must not be interpreted on its merits alone. Since the level is elevated in proportion to bone disease, and is independent of the degree of hyperparathyroidism, a normal phosphatase does not rule out hyperparathyroidism.

Ballin similarly feels that absolute biochemical findings will not always be present, or only slightly altered. The opposite viewpoint is held by Gutman, Swenson and Parsons who believe that a diagnosis of hy-

Fig. 4. Roentgenogram taken fourteen months after first admission, and after a total of 3,900 r in three cycles was given to each parathyroid area. The cysts have been replaced by dense sclerosis which has almost completely filled the cystic defects.

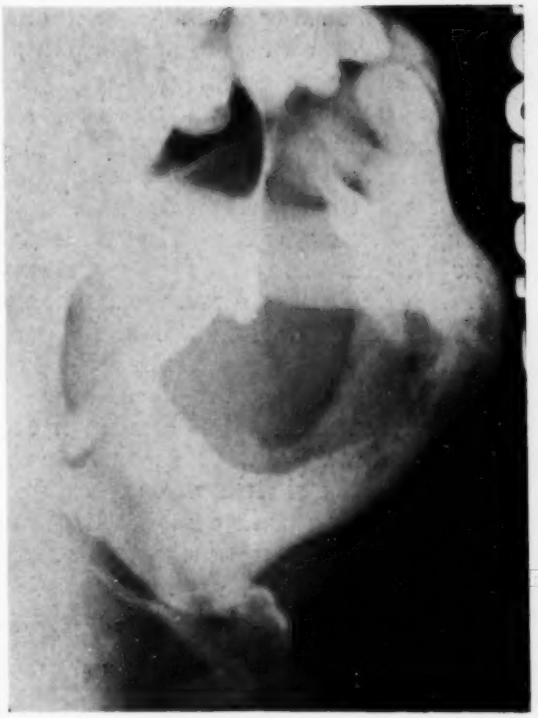

Fig. 5. Roentgenogram of the mandible taken at the same time as Figure 4. Although no sclerosis appeared, the cysts are somewhat smaller in size, and are painless.

perparathyroidism is not indicated in cases with bone lesions if the serum phosphatase is not definitely increased.

If question arises as to the positiveness of roentgenologic findings in this case, insofar as there is no generalized radiability, we quote from the experiences of Albright, Aub and Bauer who state that there may be no skeletal changes in hyperparathyroidism demonstrable roentgenologically. Furthermore, Ballin feels that the absence of roentgen findings should not always exclude the diagnosis of parathyroidism.

Apparently, therefore, a clear cut picture must not be awaited, but if suspicions arise from the history, skeletal or chemical findings, either alone or in combination, then the diagnosis of hyperparathyroidism may be assumed.

The treatment in this case was well justified. Surgery was previously attempted without success. Generally, it may be well to use irradiation rather than surgery for several reasons: there may be hyperplasia rather than adenoma of the parathyroids, and with the extreme difficulties existent in isolating tumors because of their variations in size and location, obviously small glands are even more difficult to find.

The rationale for irradiation is based upon the principle of depressing functional activity in an actively secreting gland, which finds its counterpart in the ovaries, salivary, thyroid and other glands.

SUMMARY

The case herein presented revealed evidences of skeletal changes accompanying parathyroid disturbance. An unsuccessful attempt was made at surgical removal, and following irradiation over the parathyroids, symptomatic relief from pain was obtained as well as roentgenographic evidences of bone cyst repair. The chemical findings, however, did not parallel the roentgenographic changes. Nevertheless, it was startling to observe fibrosis in a bone cyst when treating the very distant parathyroid area.

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CARCINOMA OF THE PENIS*

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BOWING, Fricke and Counseller[3] in 1932 reviewed the cases of carcinoma of the penis seen at Mayo Clinic from 1907 to 1932. One hundred and ninety-five cases were seen. In their review of the literature they allude to the abundance of reports describing one or two cases and cite the excellent detailed studies of larger series by Barringer, Dean, Colby, Lewis, Pfahler, Schreiner, and Howze. In a study of the incidence in one year at the Mayo Clinic they report a percentage of 2.94 of penile carcinoma among all carcinomas in the male. Many authors report from 1 to 3 per cent, the majority giving the latter percentage. Leighton,[7] in a review of the series at Barnard Free Skin and Cancer Hospital in 1932, reports a 1.3 per cent incidence during the previous five years. Sixty-eight cases were included in this group.

The majority of observers are agreed as to certain characteristics of carcinoma of the penis and the structures wherein it originates. It is most common between the ages of fifty and sixty years; it starts on the glans penis or prepuce, later involves both; phimosis is present in 20 to 40 per cent of the cases; the growth is either papillary or ulcerative; extension to the corpus cavernosum is delayed by the fibrous sheath of the corpus cavernosum. The superficial penile lymphatic channels empty into the inguinal lymph nodes, while the deep lymphatic channels follow the dorsal vein of the penis and empty into the pelvic nodes. As carcinoma of the penis tends to grow slowly and remain superficial for a relatively long period of time, the majority of metastases are by the superficial lymphatics to the inguinal nodes first. It is difficult to obtain data on this point, however. Barney[1] in a study of 100 cases, cited that 15, or less than 7 per cent, had metastases in the pelvis. In Barringer and Dean's[2] study of 40 patients with metastasis, 32 are known to have died of carcinoma. Others report that it is not uncommon for recurrence to follow radical gland dissection where regional metastases are known to have been present. I think it has not beem emphasized that pelvic metastasis also occurs from a superficial inguinal metastasis as well as through the lymphatics along the dorsal vein of the penis. The problem in treatment of carcinoma of the penis resolves itself mainly, therefore, into preventing pelvic metastases. What does our past clinical experience teach us in regard to this? I cannot agree that the reports of Barringer and others emphasize the futility of inguinal gland dissection. There is a significant finding in Leighton's group; 43 cases received treatment, all of the 19 who were living had bilateral inguinal gland dissections, all these glands were palpable preoperatively, 6 showed definite histologic metastases, 8 showed hyperplasia, and 4 were quite normal.

This is no different from our experience with metastasis in submaxillary lymph bearing tissue from carcinoma of the lower lip. Here we have a much larger group of cases from which to draw conclusions. We have a 50 per cent five year survival and freedom from further metastasis in this group of metastatic lymph nodes following resection of the bilateral submaxillary lymph bearing tissue.

Before discussing irradiation, or more particularly my experiences with it, I wish to cite that authors who have reported the histologic grades of malignancy in their cases of carcinoma of the penis, according to the classification of Broders,[4] show that approximately 60 per cent were of the lower grades, largely in Grade 2. This immediate-

* Read at the Twenty-fifth Annual Meeting, American Radium Society, New York, N. Y., June 10–11, 1940.

ly causes me to favor surgical ablation of the metastatic zone, particularly as it is a well defined anatomical entity and the procedure is not fraught with postoperative crippling or, let us say, economic deformity. I cannot follow or agree with those who stress the protective value of the preservation of the regional lymphatics in cancer. They argue that deep roentgen irradiation should be given in adequate dosage to destroy any possible cancer cells. From my experience surgical removal is to be preferred, not only from the standpoint of less damage to surrounding tissue as compared to roentgen irradiation, but also from the standpoint of resistance to roentgen rays or radium of cancer metastasis and particularly a low grade squamous cell carcinoma metastasis in a lymph node. In the face of a possible or probable metastasis a lymph node has ceased to be of protective value; it is a menace and is ever threatening to flare into an unregulated mass of cancer cells.

My experience with interstitial radium and roentgen irradiation to lymph bearing tissue of the neck is much more extensive both in clinic and private practice than to the lymph bearing tissue of the inguinal areas. However, the grade of malignancy in this region compares favorably with the grade of malignancy of the lower lip and its metastasis, i.e. to the submaxillary areas. I continue to be disappointed with their response to interstitial irradiation (removable cell or radon) and roentgen irradiation and it impresses me that most careful observers bear this out. An enlarged lymph node does not mean metastasis, particularly in the inguinal area draining an ulcerative or papillary carcinoma of the penis. The primary lesion always has an associated inflammation, particularly in the presence of a phimosis or if the growth has attained over 1 cm. in diameter. The same is true of the submaxillary nodes draining a carcinoma of the lower lip, so often associated with bad oral hygiene. It is difficult to ascertain correct percentages in such studies but no doubt Barney[1] is quite conservative in stating that the majority of cases of carcinoma of the penis show palpable inguinal nodes, but since the primary lesion is almost always ulcerative, it is not surprising that this adenopathy is solely due to infection in half of the instances where it occurs. I cannot agree, however, with his dictum that if the glands do not subside after amputation of the penis a dissection should be done. The glands that do not regress may be checked by biopsy also. It is not so simple as this. There are other factors to consider, such as extent of primary lesion, duration of growth, age and condition of patient, and unfortunately the recession of an inflammatory lymph node may not indicate that there is no cancer present in it. We have seen this occur too often. Thus, I recommend bilateral inguinal lymph bearing tissue resection for carcinoma of the penis unless there is a definite physical contraindication. I have seen no evidence refuting that this does not offer the better prognosis.

In the treatment of the primary lesion there is greater latitude for conservatism. A radical amputation is certainly not necessary in every case. Barney was among the first to recognize that radical surgery was not essential in the majority of cases. Barringer, Bowing, Dean, and others up to 1936, stressed the value of less radical procedures. No doubt the histologic grading of malignancy and the preponderance of low grades or differentiated growths in carcinoma of the penis was the initial stimulus for this conservatism. Since then we have noted that recurrence does not occur in the stump of the penis, and that our reason for poor results has been due largely to the metastatic rather than primary zone.

There are a number of factors to consider in the treatment of the primary lesion. At best the necessary operative procedure is mutilating; the inherent structure of the penis, its erectile tissue, is such that reconstruction is not satisfactory from any standpoint but that of fashioning a satisfactory urethral orifice. It can be said quite frankly, I think, especially during the last few years, that with surface and interstitial radium we can effectively destroy squamous

cell carcinoma in tissue and salvage a modicum of normal tissue in the zone. This, of course, signifies a good cosmetic and functional result. Radium accomplishes this in squamous cell carcinoma of the lower lip, skin, tongue, urinary bladder, and pharynx. In my experience, neither surface nor interstitial radium has been effective in carcinoma of the penis. First, it is a difficult application to make because of the inherent elasticity of the structure, but I seemingly have obtained satisfactory irradiation reactions and regressions, but recurrences have been too frequent. I do not recommend its use, I prefer surgical removal, the extent of removal depending upon the extent of the primary lesion. If surgery is refused I recommend the implanting of removable radium cells because I have obtained better results with them than with other forms of radium, except in those cases wherein the lesion is confined to the prepuce. Surface radium is most satisfactory in this group or even in a thinly involved glans penis. With more extensive lesions involving the glans penis or the spongiosum recurrence of the neoplasm has been the rule from a few months to as long as two years following irradiation.

Johnson,[6] as recently as 1938, reviewed particularly the statistical studies by various authors of incidence of enlarged inguinal lymph nodes in carcinoma of the penis. They are as follows: Kaufman, 83 per cent; Kuttner, 71 per cent; Barney, 75 per cent; Cunningham, 81 per cent; Barringer and Dean, 63 per cent; Dean, 76 per cent; or an average of approximately 75 per cent. Of these cases of enlarged nodes about 50 per cent proved to be carcinomatous, or about 37.5 per cent of all cases of penile carcinoma. He states that a review of the literature shows an almost complete accord in that surgery is the only effective method of treatment and that both roentgen and radium therapy are of little or no value.

Graves,[5] from the Pondville Hospital, reported in 1934 on 28 cases that came under his observation during the past seven years and makes two statements which are most pertinent. First, he believes that only the smallest and most superficial lesions should be regarded as suitable for treatment exclusively by radium and roentgen irradiation alone. Carcinoma of the penis is not a radiosensitive tumor. Second, the removal of the testicles is wholly without justification in most cases.

He and his group were studying the effects of deep roentgen therapy on gland bearing tissue at that time in order to form a basis for deciding whether preoperative or postoperative irradiation or both should be used. Graves stated then that high voltage roentgen therapy directed to the femoral, inguinal, and deep pelvic regions should be used in all cases following surgical dissection.

It has always seemed illogical to me to irradiate a lymph bearing area which does not contain cancer. Thus, I do not recommend roentgen irradiation of the inguinal area following resection of the lymph bearing tissue if merely hyperplasia is revealed by histologic study.

My experience with carcinoma of the penis during the past fifteen years includes mainly an actual study of 33 cases at Barnard Hospital from 1925 to 1935 and 9 cases in private practice during that same period, allowing a minimum of five years for consideration of results. Leighton has reported the Barnard series and I wish to emphasize mainly findings in regard to the regional lymphatics in this group and my private series and to correlate these findings with other authors' findings.

Barney, Barringer, Dean, and others, have stressed the protective value of preservation of the regional lymphatics. It is my experience that persistent swelling and edema of the lower extremity is not due to operative removal of the inguinal lymph bearing tissue but to malignant metastases in remaining nodes or tissues. I shall not discuss the technical aspects of the surgical procedure except to state that it is a major surgical operation. Hospitalization is long and these cases require much care. The average age of these patients was 60.5 years,

the youngest thirty-four and the oldest seventy-eight. The preferable procedure is amputation of the penis and removal of bilateral inguinal and femoral lymph bearing tissue en bloc. Whether a complete amputation of the penis with transplantation of urethral stump to perineum or partial amputation is done depends upon the extent of the carcinomatous involvement of the penis. The postoperative deaths in this series were 9 per cent, ages of these were seventy-five, sixty-nine, and sixty-four years. Seventy-five per cent of the series were living and well, free of discernible recurrence or metastases at the end of five years or longer. Twelve per cent died from cancer before five years, 3 per cent died from other causes before five years. Histologic metastases were present in 45 per cent, or, in other words, 55 per cent of these cases showed hyperplasia and not cancer in the inguinal and femoral lymph nodes. In regard to preoperative palpability in the group with histological metastasis, 12 per cent of metastatic nodes were not palpable, and of the palpable nodes 52 per cent showed metastasis.

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DISCUSSION

Dr. Archie L. Dean, New York. This excellent paper by Dr. Jorstad shows that his experience and ours have been in close accord. The most important treatment of penile cancers is the prophylactic treatment, which consists of circumcising male infants shortly after birth. This is the only treatment for this disease which is completely effective and concerning which there is no difference of scientific opinion.

The diagnosis of all lesions of the penis should be made without delay by microscopic examination. Not only is it of the greatest importance to discover any cancer early but biopsies are especially necessary to differentiate diseases of the penis because I know of no other part of the body where different diseases can appear more alike or where the same disease can show so many variations.

Unfortunately, it is easier to test blood than to examine tissue. As a result, our records frequently show the extreme misfortune of those men with penile cancers whose Wassermann tests are positive. Almost invariably courses of antiluetic therapy are given while the tumors grow unchecked.

When the nature of a penile cancer has been proved, it should be destroyed promptly and completely by the method which causes the least pain and ultimate deformity. Either irradiation or surgery may best fulfill these requirements, but the choice should be made only after careful study of the individual patient.

If a tumor is superficial and no larger than 2.5 cm. in diameter, ideal treatment can be given with low voltage roentgen rays. This carefully chosen group of earlier lesions comprise about 10 per cent of our cases of cancer of the penis. Experience has shown us that the use of irradiation for more extensive tumors is unwise.

The great majority of penile tumors are relatively radioresistant squamous cancers and their control requires destructive irradiation. Such treatment is painful but if the treated area is small, pain is not excessive and the likelihood of a good anatomic result outweighs temporary discomfort.

In extensive tumors, especially those which have infiltrated the cavernous tissues, we have not regularly controlled the disease with heavy irradiation, the resulting pain often was unbearable and the contraction of scar tissue in irradiated areas caused troublesome deformities

which not infrequently occluded the urethra.

Since surgical methods avoid these disadvantages of irradiation, and since successful operations can be performed so conservatively that little more of the penis is sacrificed than has been destroyed by disease, we operate on the great majority of cancers of the penis.

Like all other epidermoid cancers, penile tumors spread through lymphatics by embolism. For this reason it is sufficient to amputate 1 cm. proximal to any visible or palpable disease. After performing this operation more than two hundred times, I have yet to find a recurrence in the stump. The amount of organ which can be saved depends on the extent of the primary tumor but most patients can direct the flow of urine and some can perform coitus.

During the past twenty years we have unsuccessfully applied radiation in a number of ways to metastases in inguinal lymph nodes. The problem is exceedingly difficult because the tumors are radioresistant; almost invariably there is coexisting infection in the nodes; usually the nodes are surrounded by fat which does not respond actively to irradiation and the superficial tissues of the inguinal regions are relatively intolerant to irradiation.

Although inguinal dissections seldom remove all disease, at present we are treating the majority of metastatic nodes surgically. Here again a certain amount of conservatism can be advantageously practiced. Formerly any cancer of the penis was treated by total amputation, bilateral groin dissection and sometimes castration in one operation. The mortality was 20 per cent and the excised lymph nodes frequently were found inflamed rather than cancerous.

While our records show that inguinal adenopathy is present in 80 per cent of patients with cancer of the penis, only one-half have metastases. The enlarged nodes of the remaining 40 per cent are due to absorption from the ulcerating primary tumors.

In order to avoid unnecessary operations, permit infection to subside in the nodes before their removal, and to improve the patient's general condition, we operate in two stages. At the first operation the primary lesion is removed and while the patient is anesthetized, aspiration biopsies are done on any enlarged nodes. If no tumor cells are found the patient is closely observed. When metastases have been proved, we wait two to three months to permit infection to subside and then dissect the suprapubic, inguinal and femoral regions and explore the inguinal canal. We have had no deaths after this procedure.

When there is no evidence of metastases, we give no prophylactic irradiation nor have we observed any advantages from irradiation used preoperatively or postoperatively.

Dr. Jorstad (closing). I want to thank Dr. Dean for his discussion, which I consider confirmatory of the views I expressed.

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AN ATTEMPT TO CORRECT ASYMMETRY IN LEG LENGTH BY ROENTGEN IRRADIATION

A PRELIMINARY REPORT

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ASYMMETRY in leg length is a permanent disability that most seriously handicaps its possessor both socially and economically. Its correction has commanded the study of orthopedists for years, and numerous surgical operations have been devised in an effort to secure some satisfactory way of equalizing leg length. These measures have concerned both the shortening of the long leg and lengthening of the short one. On first thought, it might seem that surgery would be ideal in correcting this imbalance, but the many different operations advised by as many different operators show that none of them is entirely satisfactory. Surgical complications are frequent and serious, notably sepsis and osteomyelitis, so that the patient is often made worse by the attempt to restore his function. Among the orthopedists who have shown interest in this matter is Dr. J. Warren White[1] director of the Greenville Unit of the Shriners' Hospital for Crippled Children. White has recently devised a novel operation somewhat different from any that has been undertaken. It concerns incision into the femur just above the knee of the long leg and curettement of the osteoblastic tissue of the metaphyseal plate. His method has not been used for a sufficient length of time to warrant complete evaluation of its worth.

It was in 1934 that I became interested in this condition through my association with White. Since the results of surgery were not what they might be, we thought it worth while to attempt the retardation of growth in the long leg by means of roentgen irradiation in the hope that normal growth in the short leg would eventually offset the imbalance to some extent. Also, since it was known that very small doses of roentgen rays were capable of stimulating tissue growth, it was deemed possible to excite osteogenesis in the abnormal side by means of very small exposures of the rays to the epiphyseal regions.

Criticism of such an undertaking might well be in order; certainly the possible consequences were weighed over and over in my mind before applying this experimental work to the human. Several instances had been reported in the literature concerning damage wrought to growing bones of children by large doses of roentgen rays and radium. Bisgard and Hunt[2] report 2 such cases, one involving an index finger which became atrophic following radium treatment of a nevus, the other relating to retardation of bone growth in an extremity. Although this communication was published about two years after my work was begun, mention is made here because it is obvious from photographs in connection with the article that excessive dosage had been given. The index finger quite plainly shows the effect of overtreatment. Stevens[3] reports the case of an infant aged three months who suffered marked post-irradiation retardation in bone growth of an entire lower extremity. Although the dosage of roentgen radiation was not excessive for the disease under treatment, carcinoma, it must be realized that all the tissues of a three months' old baby are decidedly more embryonal in type, and consequently more radiosensitive, than those of a child eight or ten years of age, the age at which bone shortening might usually be desired. In defence of my attitude, I do wish to say that great care was taken to avoid damage to tissues in the path of the rays. The application of experience gained during some years of work with roentgen rays was depended upon for this purpose. No attempt was

made to deliver treatment by the "massive" method; fractional technique was employed and sufficient time allowed between courses for tissue recuperation.

Before making any attempt at shortening legs of children by this means, some animal investigation was deemed advisable. The results of a rather comprehensive study along this line were published, before my work was begun, by Brooks and Hillstrom,[4] and their findings, especially with regard to the histological aspect, were largely accepted by me as a guide in the work to be undertaken. However, it is obvious that absolute deductions are impossible from experiments done on ordinary laboratory animals because of the vast difference in the life span of such animals and the human. In order to produce retardation of bone growth in a laboratory animal the entire period of irradiation must be completed within about two months. This necessitates the use of rather massive technique. On the other hand, the growing child can be treated over a period of a few years in such a manner that a fairly large total dose can be delivered fractionally. My experiments with laboratory animals were limited to trials at stimulation of bone growth in rabbits by means of very small divided doses of roentgen rays delivered to an extremity of one side, the member of the opposite side serving as a control. Four young rabbits of a litter were selected, all apparently healthy and of identical size. A lead lined box was built of a size sufficient to hold the animal in immobilization. An aperture was made in one end of the box through which the left posterior limb was engaged and held outstretched by an elastic traction device. This served to protect the entire animal with the exception of the parts to be exposed. Amounts given were:

Rabbit No. 1—10 r twice weekly for 4 weeks. Total 80 r

Rabbit No. 2—25 r twice weekly for 4 weeks. Total 200 r

Rabbit No. 3—50 r twice weekly for 4 weeks. Total 400 r

Rabbit No. 4—75 r twice weekly for 4 weeks. Total 600 r

Measurements by means of roentgenograms of both posterior extremities made at intervals of one month failed to show any increase in growth of bone on the treated sides, so that at the expiration of six months the animals were sacrificed and the bones submitted to careful measurements for length by calipers. There was a difference of 2 mm. in length in the case of rabbit No. 3, but since there was no appreciable discrepancy in the other three cases the results were considered negative and the impression that no stimulating effect had been manifest was gained.

The factors used in this investigation, both as concerned the animal study and the human, were as follows: 200 kv. (peak), 20 ma., 52.5 cm. distance, half-value layer 0.875 mm. Cu, 27 r per minute, 0.5 mm. Cu plus 1 mm. Al as filter.

Five children were originally selected for the study, but 2 were eliminated almost immediately for the reason that they were too near the age at which epiphyseal union occurred to expect results. The remaining 3 cases constitute the material upon which incomplete conclusions were based.

Measurements of the leg lengths were made in accordance with the method used at the Greenville Unit of the Shriners' Hospital for Crippled Children for some years. The child is placed on the Potter-Bucky table in the supine position with the feet drawn down to the foot rest of the table until they are in a symmetrical position. One 14″×17″ film is made of the pelvis on the Potter-Bucky diaphragm without the grid in motion. The grid is of the old style and the strips cast their shadows which are wider apart and more obvious than those of the newer and faster grids. Since the grid lines are vertical and parallel, a perpendicular can easily be erected by the use of an ordinary square. By the use of this square a line is drawn through the uppermost part of each femoral head. The distance between the two lines represents the discrepancy in leg length. There are a few technical objections that might be raised in connection with this method, especially that in chil-

dren of various anteroposterior pelvic diameters there would be corresponding degrees of distortion. It might be argued that as the child grew larger there would be a greater distance from the hips to the film with a resultant magnification in the shadow. In order to find out just how much error might arise from this source the following simple experiment was carried out. Two square strips of lead were strapped to a tongue depressor exactly 1 inch apart. Four exposures were made on an 8″×10″ film with the strips 1, 2, 3 and 4 inches above the cassette. A focal-film distance of 30 inches was used, the same as that made use of in our leg length measurements. After the film was dry, measurements were made of the space between the lead strips. There was a difference of $\frac{1}{4}$ inch between the strips nearest the film and that farthest away. It is thus seen that this objection is not a valid one because a child would not develop to such an extent that there would be an increase by 3 or 4 inches from hips to table in two years. Therefore, the method is accepted as practical.

CASE REPORTS

Case 1. L. C., American female, aged five. Previous anterior poliomyelitis of the right lower extremity with a resultant shortening of $1\frac{1}{4}$ inches. The discrepancy had been showing an increase of $\frac{1}{2}$ inch each year. No surgery was undertaken. Roentgen treatments were begun on May 14, 1935.

Anterior Left Knee	Posterior Left Knee
5/14/35 100 r— 5/18/35 200 r	5/16/35 200 r
5/22/35 200 r	5/20/35 200 r
8/23/35 200r— 8/27/35 200 r	8/24/35 200 r— 8/25/35 200 r
11/ 4/35 200 r—11/11/35 200 r	11/ 8/35 200 r—11/13/35 200 r
2/12/36 200 r— 2/15/36 200 r	2/14/36 200 r
8/12/36 200 r— 8/14/36 100 r	8/13/36 100 r— 8/15/36 100 r
9/ 6/37 100 r— 9/ 8/37 100 r	9/ 7/37 100 r— 9/ 9/37 100 r

Case 11. W. M. G., white female, American, aged eight when therapy was begun. This was a case of discrepancy in leg length due to anterior poliomyelitis involving the lower right extremity. The attack came at the age of three months. Measurements taken on March 14, 1935, showed a discrepancy in length of $2\frac{1}{4}$ inches. No surgical measures were taken to correct the deformity. Treatment was begun March 15, 1935.

Anterior Left Knee	Posterior Left Knee
3/15/35 200 r— 3/18/35 100 r	3/16/35 200 r— 3/20/35 100 r
3/22/35 100 r— 3/25/35 200 r	3/24/35 100 r— 3/26/35 200 r
4/27/35 200 r— 5/ 1/35 200 r	4/28/35 200 r— 5/ 4/35 200 r
5/ 9/35 200 r	5/11/35 200 r
7/12/35 100 r— 7/15/35 100 r	7/13/35 100 r— 7/17/35 100 r
7/19 35 100 r	7/21/35 100 r
9/14/35 100 r—10/ 5/35 100 r	9/21/35 100 r—11/ 2/35 200 r
11/ 9/35 100 r— 1/ 4/36 100 r	12/21/35 200 r— 1/11/36 200 r
2/29/36 100 r	3/14/36 200 r

Case 111. A. M. R., white female, American. Admitted to Shriners' Hospital for Crippled Children on August 14, 1933. Diagnosis: congenital shortening of the left leg. The right leg was well developed and the exact nature of the shortening was not thoroughly understood aside from the fact that the defect was congenital. The discrepancy on admission was $3\frac{1}{2}$ inches which was reduced to $1\frac{1}{2}$ inches by a femoral shortening operation August 23, 1933. Within four years this had again increased to 3 inches, although it will be noted that roentgen treatments were begun on February 28, 1935. Treatments were as follows:

Anterior Right Knee	Posterior Right Knee
2/28/35 200 r— 3/ 2/35 200 r	3/ 1/35 200 r— 3/ 4/35 200 r
3/ 5/35 200 r	3/ 6/35 200 r
5/14/35 100 r— 5/18/35 200 r	5/15/35 200 r
5/22/35 100 r	11/13/35 200 r—11/18/35 200 r
11/11/35 200 r—11/15/35 200 r	2/14/36 200 r
2/12/36 200 r— 2/15/36 200 r	8/13/36 100 r— 8/15/36 100 r
8/12/36 100 r— 8/14/36 100 r	

In the application of roentgen rays to these children precautions were taken to avoid irradiating portions of the thigh and leg outside of the desired field. A cone 16×16 cm. was made use of and lead strips 1 mm. in thickness were used to cover all parts of the knee with the exception of the epiphyseal lines.

In evaluating the results of this work, it must be remembered that the discrepancy in leg length naturally increases by virtue of the ability of the sound leg to develop to a greater extent than the crippled one. In the 3 cases investigated this discrepancy had been increasing at the rate of about $\frac{1}{2}$ inch each year. Bearing this in mind, the results will appear to be somewhat better than the actual figures may indicate.

RESULTS

Case 1. Discrepancy at time of institution of roentgen therapy was $1\frac{1}{4}$ inches. On August 2, 1936, this had increased by $\frac{1}{2}$ inch

so that there was a difference of 1¾ inches. Six months later the discrepancy had actually reduced to 1½ inches. On January 24, 1939, measurements showed a difference of 2 inches in length, an increase of only ¾ inch in the four years after beginning treatment. In this case the deterrent effect of the irradiation is well demonstrated.

Case II. Discrepancy of 2¼ inches at time of institution of treatment. At the end of one year the difference had increased ¼ inch, there being then a difference of 2½ inches. On January 30, 1939, measurements showed that the sound leg had gained only an additional ¼ inch since February 6, 1936, a discrepancy, then, of 2¾ inches as compared to 2¼ inches four years before. Again there is indubitable evidence of the roentgen irradiation having deterred bone growth.

Case III. This child had been subjected to a femoral shortening operation prior to roentgen irradiation, and in this way a discrepancy of 3½ inches was reduced to 1½ inches. Following surgery the discrepancy again was somewhat different from the others. Here is the statement from the Chief Surgeon who showed considerable interest in the result:

> A congenital shortening of the left leg, age eight years at the time of taking of the first leg length roentgenogram four and a half years ago, which showed a discrepancy of 3½ inches. Following a femoral shortening operation this discrepancy was reduced to 1½ inches. Two and a half years ago the discrepancy had increased to 2½ inches again, five series of roentgen treatments having been given, which by that time had been completed.
>
> The leg length roentgenogram taken six months ago, that is, two years after the completion of the roentgen treatments, showed that the discrepancy had only increased 3/16 inch, indicating to me, in view of the 3½ inches' discrepancy at the start, that the roentgen therapy was exerting a deterring effect; however, it must be remembered that the 3½ inches' discrepancy was a congenital deformity the origin of which was not thoroughly understood as in the poliomyelitis cases.

SUMMARY AND CONCLUSIONS

An attempt has been made to retard the growth of the sound leg in three cases of discrepancy of leg length by means of fractional doses of roentgen rays to the growing epiphyseal lines above and below the knee.

Animal experiments done in a small way tend to prove that small doses of roentgen rays do not stimulate bone growth.

Evidence is adduced to show that bone growth can be deterred by roentgen irradiation.

Insufficient time has taken place to fully evaluate the worth of the study.

The study is to be continued on a larger scale, especially along the line of experimental work with larger, more slowly growing animals.

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ROENTGENOLOGICAL REPORT OF CHEST EXAMINATIONS

MADE OF REGISTRANTS AT U. S. ARMY INDUCTION STATION NO. 6, THIRD CORPS AREA, BALTIMORE, MARYLAND, PERIOD ENDING APRIL 30, 1941*

By HOWARD E. ASHBURY, M.D.
Chief Radiologist to Induction Station No. 6
BALTIMORE, MARYLAND

"BY ORDER of the Secretary of War, AG 702, dated October 25, 1940, directing that Chest X-rays be made on all registrants in whom, because of underweight, pallor, abnormal chest findings, or suggestive personal or family history, there appears to be an increased likelihood of pulmonary disease. In addition, they will be made routinely on all registrants so far as the local roentgenological facilities will permit and when such examinations will not retard the flow of registrants through induction boards." Because of the practicability and speed attainable paper was selected at Induction Station No. 6. The Powers X-ray Corporation was engaged to make and process the films. It was found possible to expose and process the films and report on them by the time the inductees reached the heart and lung examiner.

The paper films were interpreted by a group of radiologists selected by the Committee on Medical Defense of the Medical and Chirurgical Faculty of Maryland; this group consisted of a Chief Radiologist and a number of alternates, as follows:

Chief Radiologist

Dr. Howard E. Ashbury

Alternates

Dr. Webster H. Brown
Dr. John Evans
Dr. Whitmer B. Firor
Dr. Eugene L. Flippin
Dr. J. W. Pierson
Dr. Frank T. Rogers
Dr. Henry J. Walton
Dr. Harold E. Wright.

Radiologists were directed to follow U.S. Army mobilization Regulation MR 1-9 Standard of physical examination in their interpretation of chest roentgenograms; the following paragraphs are applicable:

MR 1-9, Section XIII,

Class 1-A, P. 49: d. (1) Arrested pulmonary tuberculosis consisting of lesions appearing in X-ray examinations as small apical scars, small calcified nodules or localized fibrous strands, in no case exceeding minimal extent as defined in the classification of the National Tuberculosis Association, and when, in addition, in the opinion of the examining physician, this lesion is not likely to be reactivated under conditions of military service.

(2) Minimal pulmonary lesions are defined as slight lesions without demonstrable excavation confined to a small part of one or both lungs. The total extent of the lesion, regardless of distribution, will not exceed the equivalent of the volume of lung tissue which lies above the second chondrosternal junction and the spine of the fourth or body of the fifth thoracic vertebra on one side.

In reference to tuberculosis the Army accepts the National Tuberculosis Association classification of two main types of disease: (1) primary, and (2) reinfection. In regard to inductees "Stable primary lesions that are healed are not disqualifying unless there is evidence of instability or there are too many primary lesions" viz., multiple primary lesions in excess of minimal even though they are stable. Stable reinfection is not disqualifying provided its distribution is minimal. When in doubt as to whether a case is primary or reinfection it was called a primary lesion because by so

* Approved for publication June 2, 1941, by the Surgeon General, U. S. Army.

doing we have not obstructed the possibility of an individual coming into the commissioned service at a later date.

Class 4, P. 51: a. Tuberculosis of lungs or tracheobronchial lymph nodes, except as defined in paragraph 49.

b. Fibrinous or serofibrinous tuberculous pleuritis, and pleurisy with effusion of unknown origin. (Inasmuch as pleurisy, with or without effusion, is a very frequent manifestation of early tuberculosis, examining physicians should examine with the greatest care registrants who have apparently recovered from pleurisy.)

c. Empyema, or unhealed sinuses of the chest wall following operation for empyema.

d. Chronic bronchitis with emphysema except as stated in paragraph 50.

e. Chronic asthma associated with chronic bronchitis and emphysema, except as stated in paragraph 50.

f. Abscess of the lung.

g. Bronchiectasis, if moderate or severe.

h. Actinomycosis.

i. Tuberculosis of the ribs and other parts of the chest wall.

j. Tumor of the breast or of the chest wall of such size and location as to interfere with the wearing of the uniform or military equipment.

k. Tumor of the lung, pleura or mediastinum.

l. Spontaneous pneumothorax.

Total Number of Chest Roentgenograms			11,870
Maryland National Guard		1,060	
Inductees		10,810	
			11,870
Chest roentgenograms negative		10,161	
Anomalies of the heart, lungs and chest wall		218	
Nontuberculous conditions		215	
Pulmonary tuberculosis			
Primary tuberculosis		1,049	
Reinfection		227	
			11,870
Disqualifying lesions:			
Cardiovascular lesions (1 aneurysm)		49	
Acute respiratory infection (deferred)		22	
Spontaneous pneumothorax		3	
Pulmonary tuberculosis			
Inductees	139		
National Guard	17		
		156	
	Total	230	
Accepted		11,640	
			11,870

In regard to cardiovascular abnormalities the chest, vessels and heart measurements were reported and accepted or rejected depending upon the correlation of the physical findings of organic disease.

The classification used in the attached numerical statement of chest conditions was adopted as a guide so that there would be some uniformity of interpretation. Roentgenologists indicated on the typed report whether the findings were acceptable or disqualifying. As far as practicable the heart and lung examiners were kept informed in advance of abnormal roentgen findings so that their examination might be speeded up.

The survey shows 1,049 cases of primary tuberculosis and 227 cases of reinfection tuberculosis, a total of 1,276 cases; a little over 10 per cent showed roentgenographic evidence of disease that was of sufficient extent to be considered reportable; very small calcified hilar nodes were reported as negative because few chest films fail to show them. Of the inductees examined 139 were rejected (1.2 per cent) for pulmonary tuberculosis. These lesions consisted of active minimal, lesions in excess of minimal although arrested, moderately advanced, far advanced and 1 case of mediastinal adenopathy. There were 10 cases with cavitation (7 per cent plus).

The Induction Board examined 11,685 inductees; a number of these men had been previously roentgenographed in Washington. Those whose papers definitely stated "chest x-ray negative" the Board was authorized to accept without further roentgen examination of the chest. In addition the radiologists roentgenographed the chests of part of the Maryland National Guard who were federalized thus bringing

SURVEY OF 11,870 CHEST ROENTGENOGRAMS OF INDUCTEES
U. S. ARMY INDUCTION STATION NO. 6, BALTIMORE, MARYLAND

Thoracic cage anomalies	Cervical ribs		21		
	Bifid ribs		47		
	Rudimentary ribs		15		
	Scoliosis		48		
	Spina bifida		2		
	Synostosis		7		
Lung anomalies	Accessory lobes		5		
	Azygos lobes		17		
Heart anomalies	Dextra cardia		4		
	Situs inversus (2, included above)				
Heart	Organic disease (1 aneurysm)		49		
				215	
Tuberculosis	Primary	Outer zone calcification (Ghon tubercles)	466		
		Mid-zone calcification	358		
		Tracheobronchial glands	16		
		Hilar glands	173		
		Miliary tuberculosis, healed	36		
				1,049	
	Adult reinfection	Minimal, 107; in excess of minimal, 73	180		
		Moderately advanced	39		
		Far advanced	8		
		Cavitation (10)			
				227	
					1,276
Mediastinal adenopathy			1		1
Pleurisy	Recent		13		
	Residual		106		
Empyema	Residual		25		
				145	
Nontuberculous infection	Bronchitis chronic*		46		
	Bronchitis chronic with emphysema*		1		
	Acute respiratory (bronchopneumonia)		22		
	Spontaneous pneumothorax		3		
				72	
					217
Chests	Negative				10,161
					11,870
Accepted					11,640
Disqualified					230
					11,870

* A roentgen diagnosis of chronic bronchitis was only made when substantiated by physical findings.

up the total number roentgenographed to 11,870. Below is listed the number of inductees examined each month with the rejection for tuberculosis included; this averaged a little less than 1.2 per cent.

Month	*Men Examined*	*Rejected for Pulmonary Tuberculosis*
November	136	3
December	30	1
January	1119	4
February	1850	31
March	3958	33
April	4602	67

The difference in rejections in March and April may be explained by the fact that many of the March inductees were not roentgenographed here because of previous roentgen examination in Washington. It will be seen by this that a large number of cases of tuberculosis were picked up so that these men never reached the Induction Board.

We are especially indebted to Dr. Frank T. Rogers, Baltimore, Maryland, for his valuable assistance in checking the major portion of the individual reports.

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Twenty-seventh Annual Meeting: Atlantic City, N. J., 1942.

EDITORIAL

THE ANNUAL MEETING

ELSEWHERE in this issue will be found the preliminary program of the forthcoming meeting of the American Roentgen Ray Society. The meeting is the forty-second in the history of the Society and it will be held at the Netherland Plaza Hotel, Cincinnati, Ohio, from September 23 to 26, 1941.

Dr. William M. Doughty, the President-Elect, and his committee have arranged a program which is very extensive in its content and should prove exceedingly interesting and instructive. In these days of uncertainty having to do with groups of individuals, Dr. Doughty deserves the congratulations of the Society in having brought together members from all parts of the country who are willing to give of their time and energy to make up a program of such diversified interest.

Needless to say, with such a program and such an attractive and centrally located city as Cincinnati, the Society can look forward to one of its very best meetings.

Supplementing the splendid scientific program, the Committee on Scientific Exhibits, of which Dr. Paul A. Bishop is Chairman, have arranged an exhibit commensurate with the general import of the meeting as gleaned from the scientific program, and the numerous social activities which have been arranged. Not the least of the latter is the annual Golf Tournament which is to be held at the Hyde Park Country Club on Monday, September 22, at which time the players will compete for the Willis F. Manges Trophy, and for the Kicker's Handicap Trophy which was generously donated by the manufacturers. It is anticipated that a great number of the members and their guests, together with the manufacturers and their guests will participate in this tournament, a notice of which is given elsewhere in this number of the JOURNAL.

The manufacturers of roentgen-ray and radium equipment have been very generous in their applications for space at the forthcoming meeting and we may look forward to an exhibit of scientific apparatus commensurate with the demands of the times.

The Caldwell Lecture is to be given by Dr. John H. Lawrence of Berkeley, California, on Tuesday evening, the 23d of September. On Thursday evening, September 25, the Annual Banquet will be held.

The Instruction Courses, which have quite recently been inaugurated as a feature of the Society's meetings, will again be offered and are again in charge of Dr. B. R. Kirklin, and elsewhere in this issue will be found the various courses that are to be given. This course of instruction in itself should be a sufficient incentive to warrant a large attendance.

The meeting, as stated above, is to be held in the Netherland Plaza which offers splendid facilities for housing a meeting of the magnitude of that of the American Roentgen Ray Society and since a great number of the members as well as guests are expected to attend this meeting, it is urged that hotel reservations be made as early as possible.

SOCIETY PROCEEDINGS, CORRESPONDENCE AND NEWS ITEMS

Items for this section solicited promptly after the events to which they refer.

MEETINGS OF ROENTGEN SOCIETIES*

United States of America

American Roentgen Ray Society
Secretary, Dr. C. B. Peirce, Royal Victoria Hospital, Montreal, Canada. Annual Meeting: Cincinnati, Ohio, Sept. 23–26, 1941.

American College of Radiology
Secretary, Mac F. Cahal, 540 N. Michigan Ave., Chicago, Ill. Annual meeting: Atlantic City, N. J., 1942.

Section on Radiology, American Medical Association
Secretary, Dr. J. T. Murphy, 421 Michigan St., Toledo, Ohio. Annual meeting: Atlantic City, N. J., 1942.

Radiological Society of North America
Secretary, Dr. D. S. Childs, 607 Medical Arts Bldg., Syracuse, N. Y. Annual meeting: San Francisco, Calif., Nov. 30–Dec. 5, 1941.

Radiological Section, Baltimore Medical Society
Secretary, Dr. Walter L. Kilby, Baltimore. Meets third Tuesday each month, September to May.

Section on Radiology, California Medical Association
Secretary, Dr. Wilbur Bailey, 2007 Wilshire Blvd., Los Angeles.

Radiological Section, Connecticut Medical Society
Secretary, Dr. Max Climan, 242 Trumbull St., Hartford, Conn. Meets bi-monthly on second Thursday, at place selected by Secretary. Annual meeting in May.

Section on Radiology, Illinois State Medical Society
Secretary, Dr. H. W. Ackemann, 321 W. State St., Rockford, Ill.

Radiological Section, Los Angeles Co. Med. Soc.
Secretary, Dr. Wilbur Bailey, 2007 Wilshire Blvd., Los Angeles, Calif. Meets on second Wednesday of each month at County Society Building.

Radiological Section, Southern Medical Association
Secretary, Dr. Roy G. Giles, Temple, Texas.

Brooklyn Roentgen Ray Society
Secretary, Dr. L. J. Taormina, 1093 Gates Ave., Brooklyn, N. Y. Meets monthly on fourth Tuesday, October to April.

Buffalo Radiological Society
Secretary, Dr. Joseph S. Gian-Francheschi, 610 Niagara St., Buffalo, N. Y. Meets second Monday of each month except during summer months.

Chicago Roentgen Society
Secretary, Dr. C. J. Challenger, 3117 Logan Blvd. Meets second Thursday of each month October to April inclusive at the Palmer House.

Cincinnati Radiological Society
Secretary, Dr. J. E. McCarthy, 707 Race St., Cincinnati, Ohio. Meets third Tuesday of each month, October to May, inclusive.

Cleveland Radiological Society
Secretary, J. O. Newton, 13921 Terrace Rd., East Cleveland. Meets at 6:30 P.M. at Midday Club on fourth Monday each month, October to April, inclusive.

Denver Radiological Club
Secretary, Dr. P. R. Weeks, 520 Republic Bldg., Denver, Colo. Meets third Friday of each month.

Detroit Roentgen Ray and Radium Society
Secretary, Dr. E. R. Witwer, Harper Hospital. Meets monthly on first Thursday from October to May, at Wayne County Medical Society Building.

Florida State Radiological Society
Secretary, Dr. J. N. Moore, 210 Professional Bldg., Ocala, Florida. Meetings in May and November.

Georgia Radiological Society
Secretary, Dr. R. C. Pendergrass, Prather Clinic Bldg., Americus, Ga. Meets in November and at annual meeting of Medical Association of Georgia in the spring.

Illinois Radiological Society
Secretary, Dr. Wm. DeHollander, St. John's Hospital, Springfield, Ill. Meets three times a year.

Indiana Roentgen Society
Secretary, Dr. H. C. Ochsner, Methodist Hospital, Indianapolis. Meeting held the second Sunday in May annually.

Kentucky Radiological Society
Secretary, Dr. J. C. Bell, 402 Heyburn Bldg., Louisville. Meets annually in Louisville on third Sunday afternoon in April.

Long Island Radiological Society
Secretary, Dr. Marcus Wiener, 1430-48th St., Brooklyn, N. Y. Meets Kings County Med. Soc. Bldg. monthly on fourth Thursday, October to May, 8:30 P.M.

Louisiana Radiological Society
Secretary, Dr. J. R. Anderson, 1130 Louisiana Ave., Shreveport. Meets annually during Louisiana State Medical Society meeting. Next meeting New Orleans, April, 1942.

Michigan Association of Roentgenologists
Secretary, Dr. J. E. Lofstrom, 1536 David Whitney Bldg., Detroit. Three meetings a year, Fall, Winter, Spring.

Milwaukee Roentgen Ray Society
Secretary, Dr. I. I. Cowan, Mt. Sinai Hospital, Milwaukee, Wis. Meets monthly on first Friday at University Club.

Minnesota Radiological Society
Secretary, Dr. J. P. Medelman, 572 Lowry Medical Arts Bldg., St. Paul.

Nebraska Radiological Society
Secretary, Dr. D. A. Dowell, Medical Arts Bldg., Omaha, Nebr. Meets third Wednesday of each month, at 6 P.M. at either Omaha or Lincoln.

New England Roentgen Ray Society
Secretary, Dr. A. O. Hampton, Massachusetts General Hospital, Boston, Mass. Meets monthly on third Friday, Boston Medical Library.

Radiological Society of New Jersey
Secretary, Dr. H. J. Perlberg, 921 Bergen Ave., Jersey City. Meets annually at time and place of State Medical Society. Mid-year meetings at place chosen by president.

New York Roentgen Society
Secretary, Dr. E. J. Ryan, St. Luke's Hospital, New York City. Meets monthly on third Monday, New York Academy of Medicine, at 8:00 P.M.

North Carolina Roentgen Ray Society
Secretary, Dr. Major Fleming, Rocky Mount, N. C. Annual meeting at time and place of State Medical Society. Mid-year scientific meeting at place designated.

Central New York Roentgen Ray Society
Secretary, Dr. C. F. Potter, 820 S. Crouse Ave., Syracuse. Three meetings a year. January, May, November.

Ohio Radiological Society
Secretary, Dr. J. E. McCarthy, 707 Race St., Cincinnati. Meets at time and place of annual meeting of Ohio State Medical Association.

Pacific Roentgen Society
Secretary, Dr. L. H. Garland, 450 Sutter St., San Francisco, Calif. Meets annually, during meeting of California Medical Association.

Pennsylvania Radiological Society
Secretary, Dr. L. E. Wurster, 416 Pine St., Williamsport.

Philadelphia Roentgen Ray Society
Secretary, Dr. B. R. Young, Temple University Hospital. Meeting first Thursday of each month from October to May inclusive, at 8:15 P.M., in Thompson Hall, College of Physicians, 19 S. 22d St.

Pittsburgh Roentgen Society
Secretary, Dr. H. W. Jacox, 4800 Friendship Ave. Meets second Wednesday each month, 4:30 P.M., October to June, Pittsburgh Academy of Medicine.

Rochester Roentgen Ray Society, Rochester, N. Y.
Secretary, Dr. S. C. Davidson, 277 Alexander St. Meets on second Thursday from October to May, inclusive, 8 P.M., Rochester Academy of Medicine Building.

* Secretaries of Societies not here listed are requested to send the necessary information to the Editor.

St. Louis Society of Radiologists
Secretary, Dr. W. K. Mueller, University Club Bldg. Meets fourth Wednesday of October, January, March and May, at a place designated by the president.

San Francisco Radiological Society
Secretary, Dr. H. A. Hill, 450 Sutter St., San Francisco. Meets monthly on third Thursday at 7:45 P.M., first six months at Toland Hall, second at Lane Hall.

South Carolina X-Ray Society
Secretary, Dr. T. A. Pitts, Baptist Hospital, Columbia, S. C. Meets in Charleston on first Thursday in November, also at the time and place of South Carolina State Medical Association.

Tennessee Radiological Society
Secretary, Dr. F. B. Bogart, 311 Medical Arts Bldg., Chattanooga, Tenn. Meets annually at the time and place of the Tennessee State Medical Association.

Texas Radiological Society
Secretary, Dr. L. W. Baird, Scott and White Hospital, Temple, Texas.

University of Michigan Department of Roentgenology Staff Meeting
Meets each Monday evening from September to June, at 7 P.M. at University Hospital.

University of Wisconsin Radiological Conference
Secretary, Dr. E. A. Pohle, 1300 University Ave., Madison, Wis. Meets every Thursday from 4:00–5:00 P.M., Room 301, Service Memorial Institute.

Virginia Radiological Society
Secretary, Dr. C. H. Peterson, 603 Medical Arts Bldg., Roanoke, Va. Meets annually in October.

Washington State Radiological Society
Secretary, Dr. K. J. Holtz, American Bank Bldg., Seattle. Meets fourth Monday of each month at the College Club, Seattle.

X-Ray Study Club of San Francisco
Secretary, Dr. J. M. Robinson, University of California Hospital. Meets monthly in evening on third Thursday.

Cuba

Sociedad de Radiología y Fisioterapia de Cuba
President, Dr. J. Manuel Viamonte, Hospital Mercedes, Habana, Cuba. Meets monthly in Habana.

British Empire

British Institute of Radiology Incorporated with the Röntgen Society
Meets monthly on third Thursday from November to June inclusive, at 8:15 P.M., 32 Welbeck St., London.

Section of Radiology of the Royal Society of Medicine (Confined to Medical Members)
Meets on the third Friday of each month during the winter at 8:15 P.M. at the Royal Society of Medicine, 1, Wimpole St., London, W. 1.

Faculty of Radiologists
Secretary, Dr. M. H. Jupe, 32 Welbeck St., London, W. 1, England.

Section of Radiology and Medical Electricity, Australasian Medical Congress
Secretary, Dr. H. M. Cutler, 139 Macquarie St., Sydney, New South Wales.

Radiological Section of the Victorian Branch of the British Medical Association
Secretary, Dr. Keith Hallam, St. George's Hospital, K.E.W., Melbourne, E. 4, Victoria, Australia. Meets monthly from March to November inclusive.

Canadian Association of Radiologists
Secretary, Dr. A. C. Singleton, Medical Arts Bldg. Toronto, 5, Ontario.

Section of Radiology, Canadian Medical Association
Secretary, Dr. C. M. Jones, Inglis St., Ext., Halifax, N.S.

Radiological Section, New Zealand British Medical Association
Secretary, Dr. Colin Anderson, Invercargill, New Zealand. Meets annually.

Continental Europe

Belgian Society of Roentgenology
Secretary, Dr. J. Boine, Avenue des Alliés, 134, Louvain (Belgium). Meets monthly on second Sunday at d'Egmonds Palace, Brussels, except in the summertime.

Sociedad Espanola de Radiologia y Electrologia
Secretary, Dr. J. Martin-Crespo, Fuencarral, 7. Madrid, Spain. Meets monthly in Madrid.

Société de Radiologie Médicale de France
Meets monthly on second Tuesday, except during months of August and September, 12 Rue de Saine, Paris.

Société Suisse de Radiologie (Schweizerische Röntgen-Gesellschaft)
Secretary for French language, Dr. A. Grosjean La Chaux de Fonds.
Secretary for German language, Dr. Scheurer, Molzgasse, Biel. Meets annually in different cities.

Société Francaise d'Electrothérapie et de Radiologie Médicale
Meets monthly on fourth Tuesday, except during months of August and September, 12 Rue de Seine, Paris.

Association of German Roentgenologists and Radiologists in Czecho-Slovakia
Secretary, Dr. Walter Altschul, German University, Prague, 11.52.

Deutsche Röntgen-Gesellschaft (Gesellschaft für Röntgenkunde und Strahlenforschung)
Meets annually in April, alternating one year in Berlin, one year in some other German city. Meets in addition every two years with the Gesellschaft deutscher Naturforscher und Aertze.
Permanent Secretary, Professor Dr. Haenisch, Klopstockstrasse 10, Hamburg, Germany.

Süd- und Westdeutsche Röntgengesellschaft
Meets annually in different cities.

Nord- und Ostdeutsche Röntgengesellschaft
Meets annually in different cities.

Dutch Society of Electrology and Roentgenology
Holds two meetings a year in Amsterdam, one in the spring, and one in the fall.

Societa Italiana Radiologia Medica
Secretary, M. Ponzio, University of Turin, Prof. Turin.

Societatea Romana de Radiologie si Electrologie
Secretary, Dr. Oscar Meller, Str. Banul Mărăcine, 30, S. I., Bucuresti, Roumania. Meets second Monday in every month with the exception of July and August.

All-Russian Roentgen Ray Association, Leningrad, USSR in the State Institute of Roentgenology and Radiology, 6 Roentgen St.
Secretaries, Drs. S. A. Reinberg and S. G. Simonson. Meets annually.

Leningrad Roentgen Ray Society
Secretaries, Drs. S. G. Simonson and G. A. Gusterin. Meets monthly, first Monday at 8 o'clock State Institute of Roentgenology and Radiology, Leningrad.

Moscow Roentgen Ray Society
Secretaries, Drs. L. L. Holst, A. W. Ssamygin and S. T. Konobejevsky. Meets monthly, first Monday, 8 P.M.

Scandinavian Roentgen Societies
The Scandinavian roentgen societies have formed a joint association called the Northern Association for Medical Radiology, meeting every second year in the different countries belonging to the Association. Each of the following societies, with exception of the Denmark Society, meets every second month except in the summertime.

Society of Medical Radiology in Sweden
Meets in Stockholm.

Society of Medical Radiology in Norway
Meets in Oslo.

Society of Medical Radiology in Denmark
Secretary, Dr. G. Biering, Copenhagen. Meets second Wednesday each month October to July in Copenhagen, at 8 o'clock in State Institute of Roentgenology.

Society of Medical Radiology in Finland
Meets in Helsingfors.

Vienna Roentgen Society
Meets first Wednesday of each month, at 6:30 P.M. at Zentral-Röntgen Institut des allgemeinen Krankenhauses Alserstrasse 4.

Orient

Japan X-Ray Association
c/o Orthopedic Surgery, Tokyo Imperial University. Meets annually in April.

Kinki Roentgen-Abend Society
Director, Dr. Prof. Taiga Saito, Ogawaoike Tyotc, Japan. Meets bi-monthly on third Sunday.

PRELIMINARY PROGRAM

FORTY-SECOND ANNUAL MEETING OF THE AMERICAN ROENTGEN RAY SOCIETY

The Forty-second Annual Meeting of the American Roentgen Ray Society will be held at the Netherland Plaza, Cincinnati, Ohio, on September 23, 24, 25, and 26, 1941.

The meeting of the Executive Council will be held at noon on Sunday, September 21.

The Willis F. Manges Memorial Golf Tournament will be held at the Hyde Park Country Club on Monday, September 22, Ellis F. Bader, M.D., Chairman.

The scientific program has been arranged as follows:

Tuesday, September 23, 1941

8:00 A.M. Instruction Courses (see page 253)

11:00 A.M. Call to Order, Forty-second Annual Meeting
Merrill C. Sosman, M.D., President

Presentation of Medals and Certificates of Merit awarded for Scientific Exhibits at the Forty-first Annual Meeting
President Sosman

Address of Welcome: Dr. Raymond C. Walters, President, University of Cincinnati

Installation of the President-Elect, William McDowell Doughty, M.D., Cincinnati, Ohio, by President Sosman and the Chairman of the Executive Council, Raymond C. Beeler, M.D., Indianapolis, Ind.

11:30 A.M.

Paper No.

1. The Result of Chest Surveys for the Canadian Army: With Comments on the Value of the 14″×17″ Film (15 minutes) Gordon E. Richards, M.D., Toronto, Canada
2. Technical Factors Underlying Miniature Chest Roentgenography (15 minutes) Hollis E. Potter, M.D., Chicago, Ill.
3. Evaluation of Methods for Mass Survey of the Chest (15 minutes) Arthur C. Christie, M.D., Washington, D. C.

Discussion of Papers 1–3 (incl.) to be opened by: Carleton B. Peirce, M.D., Montreal, Canada and Kennon Dunham, M.D., Cincinnati, Ohio (5 minutes each)

4. Two Years' Experience with 1,000,000 Volt Roentgen Therapy (15 minutes) Alfred F. Hocker, M.D., New York, N. Y. (by invitation)

12:45 P.M. Luncheon Recess

2:00 P.M.

5. Post-Traumatic Painful Osteoporosis: A Clinical and Roentgenological Entity (15 minutes) Louis G. Herrmann, M.D. (by invitation), Harold G. Reineke, M.D., and John A. Caldwell, M.D. (by invitation), Cincinnati, Ohio.
6. Lymphosarcoma: With Special Reference to the Reticulum-Cell Type (15 minutes) E. L. Jenkinson, M.D., R. E. Kinzer, M.D. (by invitation), and W. H. Brown, M.D. (by invitation), Chicago, Ill.
7. The Value of the Roentgen Therapeutic Test Dose in the Differential Diagnosis of Mediastinal Tumors (15 minutes) Lawrence Reynolds, M.D., and Traian Leucutia, M.D., Detroit, Mich.

Discussion of Papers 6 and 7 to be opened by U. V. Portmann, M.D., Cleveland, Ohio, and John T. Murphy, M.D., Toledo, Ohio (5 minutes each)

8. Dosage Measurements in Contact Therapy (15 minutes) Edith H. Quimby, M.S., Sc.D., and Elizabeth F. Focht (by invitation) New York, N. Y.
9. Classification of Epithelial Cancer Based upon Site of Origin (15 minutes) E. A. Merritt, M.D., and Ralph M. Caulk, M.D. (by invitation), Washington, D. C.

4:30 P.M. Executive Business Session of the Society.

Tuesday Evening September 23, 1941, Eight-Thirty O'Clock

Introduction—Eugene P. Pendergrass, M.D., Philadelphia, Pa.

The Caldwell Lecture

John Hundale Lawrence, M.D., Berkeley, California

Presentation of Medal—President Doughty

Wednesday, September 24, 1941

8:00 A.M. Instruction Courses (see page 253).

11:00 A.M.

Paper No.

10. Contributions of Roentgenology to the Diagnosis of Chronic Constrictive Pericarditis (15 minutes) John R. Carty, M.D., John R. Seal, M.D. (by invitation), and Harold J. Stewart, M.D. (by invitation), New York, N.Y.
11. Diagnosis of Congenital Heart Lesions (15 minutes) George W. Grier, M.D., Pittsburgh, Pa.
12. Cor Pulmonale (15 minutes) Leo G. Rigler, M.D., and Phillip Hallock, M.D. (by invitation), Minneapolis, Minn.
13. Intrapericardial and Intracardiac Calcifications (15 minutes) Merrill C. Sosman, M.D., Boston, Mass. Discussions of Papers 10–13 (incl.) to be opened by M. A. Blankenhorn, M.D., Cincinnati, Ohio (by invitation)

12:30 P.M. Luncheon Recess

2:00 P.M.

14. Inflammation, Please (Or Tb. or not Tb. That Is the Question).
    Interlocutor—Merrill C. Sosman, M.D., Boston, Mass.
    End Men—W. Edward Chamberlain, M.D., Philadelphia, Pa., Eugene P. Pendergrass, M.D., Philadelphia, Pa.
    Moderator—Aubrey O. Hampton, M.D., Boston, Mass.
    This will be a one-hour clinical session in an "Information, Please" type of program.

3:00P.M.

15. The Sphenoidal Fissures: An Anatomical, Roentgenological and Clinical Study (15 minutes) Karl Kornblum, M.D., and George B. Kennedy, M.D. (by invitation) Philadelphia, Pa.
16. Vitamin Assays in Cancer Patients (15 minutes) Jules C. Abels, M.D., New York, N.Y. (by invitation)
17. The Vertebral Vein System as a Mechanism for the Spread of Metastases (15 minutes) Oscar V. Batson, M.D. Philadelphia, Pa. (by invitation)
18. Renal Complications of Carcinoma of the Cervix (15 minutes) Esther C. Marting, M.D., Cincinnati, Ohio (by invitation)
19. Renal Complications in Cases of Carcinoma of the Uterine Cervix: Management and Prognosis (15 minutes) Harry H. Bowing, M.D. (by invitation), and Robert E. Fricke, M.D., Rochester, Minn.
    Discussion of Papers 16–19 (incl.) to be opened by Parke Smith, M.D., Cincinnati, Ohio (by invitation)
20. Diaphragmatic Hernia (15 minutes) S. W. Harrington, M.D., Rochester, Minn. (by invitation)
    Discussion to be opened by B. N. Carter, M.D., Cincinnati, Ohio (by invitation) 5 minutes

5:00 P.M. View Scientific and Commercial Exhibits. (Scientific Exhibits will be open until 8:30 P.M.)

Thursday, September 25, 1941

8:00 A.M. Instruction Courses (see page 253)

11:00 A.M.

Paper No.

21. Roentgen Manifestations of Toxoplasmosis (15 minutes) L. R. Sante, M.D., St. Louis, Mo.
22. Infantile Toxoplasmic Encephalomyelitis: Clinical Importance of Roentgenographic Evidence (15 minutes) Cornelius G. Dyke, M.D., Abner Wolf, M.D. (by invitation), and John Caffey, M.D. (by invitation), New York, N.Y.
    Discussion of Papers 21 and 22 to be opened by Leo G. Rigler, M.D. Minneapolis, Minn., and Justin McCarthy, M.D., Cincinnati, Ohio (5 minutes each)
23. The Gastrointestinal Tract in the Healthy Newborn Infant (15 minutes) Samuel G. Henderson, M.D., Pittsburgh, Pa. (by invitation)

Discussion to be opened by Walter W. Wasson, M.D., Denver, Colo. and Robert Lyon, M.D. Cincinnati, Ohio (by invitation)

24. Atelectasis Following Pneumonia in Children (15 minutes) George M. Wyatt, M.D., Boston, Mass.

Discussion to be opened by Frank E. Stevenson, M.D., Cincinnati, Ohio (by invitation) 5 minutes

12:30 P.M. Luncheon Recess

2:00 P.M.

25. The Manifestations of Vitamin Deficiencies as They Affect the Practice of Roentgenologists. Tom D. Spies, M.D., Birmingham, Ala. (by invitation)

3:00 P.M.

26. Eosinophilic Granuloma and Certain Other Reticulo-endothelial Hyperplasias of Bone: A Comparison of Clinical, Roentgenologic and Pathologic Features (15 minutes) Harold W. Jacox, M.D., and Paul Gross, M.D. (by invitation), Pittsburgh, Pa.

Discussion to be opened by Clare Rittershofer, M.D., Cincinnati, Ohio (by vitation) 5 minutes

27. Experimental Production of Congenital Skeletal Abnormalities in Rats (15 minutes) Josef Warkany, M.D. (by invitation), and Rose C. Nelson, Ph.D. (by invitation), Cincinnati, Ohio.

28. A Study of Bone Changes Occurring in Congenital Syphilis (15 minutes) John W. Pierson, M.D., and George J. Farber, M.D. (by invitation), Baltimore, Md.

Discussion to be opened by Robert Ward, M.D., Cincinnati, Ohio (by invitation) 5 minutes.

29. Osteochondrodystrophy (15 minutes) Ralph S. Bromer, M.D., and Rolfe M. Harvey, M.D. (by invitation) Bryn Mawr, Pa.

Discussion to be opened by Josef Warkany, M.D., Cincinnati, Ohio (by invitation) 5 minutes.

4:30 P.M. Executive Business Session of the Society.

Thursday Evening, September 25, 1941

Pavilion Caprice
Seven O'Clock—Cocktails

Seven-Thirty O'Clock—The Annual Banquet

Friday, September 26, 1941

8:00 A.M. Instruction Courses (see page 253)

9:15 A.M.

Paper No.

30. Intraspinal Thorotrast (15 minutes) William A. Nosik, M.D., Cleveland, Ohio (by invitation)

31. The Removal of Lipiodol from the Lumbar Subarachnoid Spaces by Lumbar Puncture (15 minutes) Aubrey O. Hampton, M.D., and Charles S. Kubic, M.D. (by invitation) Boston, Mass.

32. Myelography: An Evaluation of Various Techniques (15 minutes) Hugh F. Hare, M.D., Boston, Mass.

Discussion of Papers 30–32 (incl.) to be opened by Joseph C. Bell, M.D., Louisville, Ky., and F. H. Mayfield, M.D., Cincinnati, Ohio (by invitation) (5 minutes each)

33. Fallopian Tube Visualization as a Therapeutic Measure in Sterility (15 minutes) Charles L. Martin, M.D., Dallas, Texas.

34. Radiation Treatment of Pituitary Adenomas (15 minutes) H. Dabney Kerr, M.D., and Wayne K. Cooper, M.D. (by invitation) Iowa City, Iowa.

35. Roentgen Therapy of Cerebellar Tumors (15 minutes) Eugene P. Pendergrass, M.D., Philip J. Hodes, M.D., and Ellwood W. Godfrey, M.D. (by invitation), Philadelphia, Pa.

36. Further Observation of Roentgen-Ray Effects on the Brains of Experimental Animals (15 minutes) Lawrence Reynolds, M.D., K. E. Corrigan, Ph.D., H. S. Hayden, Ph.D. (by invitation) and W. J. Derbyshire, Ph.D. (by invitation), Detroit, Mich.

Discussion of Papers 34–36 (incl.) to be opened by Merrill C. Sosman, M.D., Boston, Mass. (5 minutes)

37. The Meniscus Sign-Complex: A Pathognomonic Index of Early Ulcerating Cancer of the Stomach (15 minutes) B. R. Kirklin, M.D., Rochester, Minn.
38. A Stellate Impression in the Cardiac End of the Stomach Simulating a Tumor (15 minutes) Fred M. Hodges, M.D., Lawrence O. Snead, M.D., and R. A. Berger, M.D. (by invitation), Richmond, Va.

Discussion of Papers 37 and 38 to be opened by E. L. Jenkinson, M.D., Chicago, Ill. and Ross Golden, M.D., New York, N.Y. (5 minutes each)

12:30 P.M. Luncheon Recess

2:00 P.M.

39. The Roentgen Appearance of Intramural, Extramucosal Lesions of the Gastrointestinal Tract (15 minutes) Richard Schatzki, M.D., Boston, Mass.
40. The Roentgen Diagnosis of Lesions Involving the Ileum, Cecum and Proximal Ascending Colon (15 minutes) Eugene P. Pendergrass, M.D., Philadelphia, Pa., and George W. Chamberlin, M.D., Reading, Pa.
41. Lymphoblastomata Primary in the Gastrointestinal Tract (15 minutes) Harry M. Weber, M.D., Rochester, Minn.

Discussion of Papers 39–41 (incl.) to be opened by Ross Golden, M.D., New York, N.Y.

42. Low Absorption Roentgen-Ray Measurements from 10 to 250 Kilovolts (15 minutes) E. D. Trout, A.B., and Z. J. Atlee, B.S., Chicago, Ill.

AMERICAN ROENTGEN RAY SOCIETY

SECTION ON INSTRUCTION

B. R. Kirklin, M.D., *Director*

Abstracts of Courses Offered

Forty-second Annual Meeting

Netherland Plaza Hotel, Cincinnati, Ohio

September 23–26, 1941

President-Elect Doughty, with the approval of the Executive Council, has directed that the Section on Instruction be continued for the 1941 annual meeting. He has arranged his program so that the instruction courses will be given between the hours of 8:00 A.M. and 10:45 A.M. on Tuesday, Wednesday and Thursday, and 8:00 A.M. and 9:15 A.M. on Friday. Nothing else will be scheduled during these hours, thus allowing everyone at the meeting to attend the Instruction Courses each morning.

This Section presents for 1941:

1. Five Special Sequential Courses, lettered "A" to "E", with a faculty of fifteen instructors and covering fifteen periods.

2. Seven single-period courses on Radiation Physics, with a faculty of eight instructors and covering seven periods.

3. Thirteen single-period courses on Therapeutic Radiology, with a faculty of thirteen instructors and covering twenty periods.

4. Thirty-five single-period courses on Diagnostic Roentgenology, with a faculty of thirty-eight instructors and covering forty-two periods.

GENERAL INFORMATION

Conference Periods

Tuesday, Wednesday, Thursday and Friday mornings

First period.....8:00 to 9:15
Second period.....9:30 to 10:45

Location

All courses will be given in parlors A to S located on the fourth floor of the Netherland Plaza Hotel. Full information may be secured at the general registration desk which will be located nearby.

Code

The instruction periods will be designated with the following code:

T-1	Tuesday, first period	8:00 to 9:15
T-2	Tuesday, second period	9:30 to 10:45
W-1	Wednesday, first period	8:00 to 9:15
W-2	Wednesday, second period	9:30 to 10:45
Th-1	Thursday, first period	8:00 to 9:15
Th-2	Thursday, second period	9:30 to 10:45
F-1	Friday, first period	8:00 to 9:15

(Familiarity with this code will avoid much confusion)

How To Secure Tickets for Instruction Courses

Admission to the Instruction Courses will be by ticket only.

Following the abstracts of the courses will be found a pink general order sheet. First, second and third choices for each period should be carefully selected as the number attending each course given during these periods will be limited to from thirty to forty persons. If directions as given on the order sheet are followed explicitly, errors in completing reservations will be minimized.

If you are requesting registration in one or more of the Special Sequential (continuous) Courses, please indicate for each period your second and third choices of individual single-period courses as substitutes —to avoid disappointment should the Sequential Courses be filled when your order is received.

It is possible for one to attend only seven periods of instruction, so the condensed schedule should be noted carefully in arranging individual orders for tickets.

Reservations will be made in the order of receipt of the pink forms. Those who are not members of the American Roentgen Ray Society will be charged a nominal fee of $1.00 per period, or a maximum fee of $5.00 for five or more periods. Full time graduate students in Radiology will be admitted without fee.

Previous to September 12, send orders to Rochester, Minnesota; after September 12, send orders directly to Dr. B. R. Kirklin, Netherland Plaza Hotel, Cincinnati, Ohio.

If the courses are not filled by the time of the meeting, tickets will be available at the registration desk, located on the Fourth Floor, on Sunday, September 21, and thereafter during the meeting.

Holders of Tickets

Those who do not have a proper ticket for the assigned course will not be permitted to enter the room. Pages will be assigned to each conference room to collect tickets.

Duplications and Repeats

Due to the anticipated heavy registration a few of the single-period courses will be repeated and others will be duplicated by two or more instructors.

SEQUENTIAL COURSES

COURSE: A

(2 periods)

Room: D **Periods: W-2; Th-2**

MAJOR A. A. DE LORIMIER, U. S. Army
MAJOR ARTHUR W. FUCHS, U. S. Army

Roentgenology of the Chest as Outlined by the United States Army

This course is intended to portray the essentials concerned with the roentgenological aspects of chest examinations of candidates for the United States Army. Particular consideration will be given lesions which are characteristic of pulmonary tuberculosis; findings which are considered acceptable versus those which should be considered basis for rejection. Certain technical features concerned with roentgenography will be presented. The aim is to describe the aspects which should be practiced at Army Induction Centers. These aspects should indicate what is expected of similar examinations conducted by local boards. It is hoped that the practices will coincide with the viewpoints of others engaged in general industrial surveys.

COURSE: B

(3 periods)

Room: G **Periods: T-2; W-2; Th-2**

ROSS GOLDEN, M.D., New York City
PAUL C. SWENSON, M.D., New York City

Roentgenology of the Small Intestine

Tuesday

- Technique
- Normal small intestine
  - Anatomy
  - Physiology
- Indications for small intestine study
- Diverticula
- Disturbances in physiology
  - Emotion
  - Vagotonia
  - Multiple peritoneal adhesions
- Developmental anomalies
  - Internal hernia
  - Congenital diaphragm
- Effect of disease of the mesentery
  - Localized
  - Generalized
    - Lymphoblastoma
    - Sclerosing mesenteritis

Wednesday

- The "Deficiency Pattern"
  - Vitamin deficiency states
  - Hypoproteinemia
  - Biliary tract disease
  - Pancreatic disease
- Allergy
- Inflammations
  - Tuberculous
  - Non-tuberculous
    - Sclerosing regional enteritis
    - Non-sclerosing regional enteritis

Thursday

- Neoplasms
  - Benign
  - Malignant
    - Carcinoma and carcinoid
    - Lymphosarcoma
      - Localized
      - Diffuse

Benign ulcer
Ileus
Diagnosis by 3 position abdominal films
Paralytic
Mechanical
Mesenteric vascular occlusion
The Miller-Abbott tube
Technique of insertion
Deflation
Injection of barium for
1. Localization
2. Demonstration of type of obstruction
Complications

COURSE: C

(4 periods)

Room: G **Periods: T-1; W-1; Th-1; F-1**

JOHN T. MURPHY, M.D., Toledo, Ohio
PLINN F. MORSE, M.D., Detroit, Michigan

Radiologic-Pathologic Conference on Tumors of Bone

This course will be conducted as a radiologic-pathologic teaching seminar and all those in attendance may participate in the discussion.

Both the roentgenologic and microscopic findings of tumors of bone will be shown and discussed. The clinical course of the cases shown will be stressed and a complete follow-up of each patient will be presented. Considerable time will be devoted to the differential roentgenologic diagnosis.

This is a Sequential Course and no part of it will be repeated.

COURSE: D

(2 periods)

Room: I **Periods: W-1; W-2**

EUGENE P. PENDERGRASS, M.D., Philadelphia, Pa., Director
S. W. HARRINGTON, M.D., Rochester, Minn.
MONT R. REID, M.D., Cincinnati, Ohio
MAURICE LENZ, M.D., New York City
FREDERICK W. O'BRIEN, M.D., Boston, Mass.
CHARLES L. MARTIN, M.D., Dallas, Texas
HARRIET C. McINTOSH, M.D., New York City
H. H. BOWING, M.D., Rochester, Minn.

A Panel Discussion of Carcinoma of the Breast

This discussion is planned primarily to consider many of the practical problems that arise concerning the treatment of carcinoma of the breast. A number of physicians who have had a large experience have been selected in order that those who attend the meeting may have the benefit of their recommendations.

Some of the points that will be considered include:

a. What is the value of pre- and postoperative roentgen therapy in operable cases?
b. How does one treat inflammatory carcinoma?
c. How does one treat recurrences?
d. What is the value of ovarian irradiation in operable and inoperable carcinoma?

Mimeographed copies of pertinent thoughts will be distributed to all those present, and it is planned to have a reporter make a record of the discussion.

COURSE: E

(4 periods)

Room: H **Periods: T-1; W-1; Th-1; F-1**

W. WALTER WASSON, M.D., Denver, Colo.

The Anatomy, Physiology, and Mechanics of the Chest as a Basis for the Study of Chest Diseases and Their Classification

This is an effort to portray the chest so that the clinician or radiologist can actually visualize the thoracic viscera and their diseases. A child begins life with certain anatomical structures which change with the years both as a result of physiological processes and disease. The pathological reactions which the clinician or the radiologist is called upon to diagnose are definitely influenced by the particular physiology and mechanics of this anatomy. Accordingly, any classification of chest disease must be based upon the pathological reactions of disease as influenced by anatomy and of the physiology and mechanics of this anatomy.

The presentation will be made in the following sections:

1. Anatomy of the Lungs.	Period: T-1
2. Physiology and Mechanics of the Chest and Particularly of the Lungs.	Period: W-1
3. The Classification of Diseases of the Lungs.	Period: Th-1
4. Illustrations of the Different Diseases of the Lungs and their Diagnosis.	Period: F-1

SINGLE PERIOD COURSES

RADIATION PHYSICS

COURSE: 101

Room: L **Period: F-1**

G. FAILLA, D.Sc., New York City

Some Aspects of Radiosensitivity

Variation of radiosensitivity with cell type, stage of development, etc.

Influence of circulation on cell reaction to radiation in accordance with author's theory of the biological action of ionizing radiations. Experimental findings tending to support theory.

Relative radiosensitivity of normal and pathological tissues most important factor in radiation therapy. Ways in which radiosensitivity ratio may be improved. Possible influence of wave length on this ratio.

Applications to some practical problems.

COURSE: 102

Room: L **Period: T-1**

OTTO GLASSER, Ph.D., Cleveland, Ohio
U. V. PORTMANN, M.D., Cleveland, Ohio

Dosage Measurements with the Thimble Chamber in Practice

The historical development of thimble chamber dosimeters, their calibration in roentgens, the measurement of quantity and quality, depth dose and back-scattering in phantoms will be discussed. The difference between the thimble chamber dosimeters and other types of dosimeters will be discussed. Likewise, the clinical applications of the thimble chamber will be discussed.

COURSE: 103

Room: L **Period: T-2**

GEORGE C. HENNY, M.Sc., M.D., Philadelphia, Pa.

Roentgen Film Characteristics and the Practical Calibration of Roentgenographic Apparatus and Processing Solutions

The characteristics of the roentgen film emulsion (together with intensifying screens if they are used), in which the roentgenologist is mainly concerned, are the "speed" and the "contrast." These characteristics are of great importance.

The "speed" determines the degree of darkening of the processed film, after standard development, for a given roentgenographic exposure and a particular anatomic part.

The "contrast," under the same conditions, determines the degree to which tissue density-differences and thickness-differences of the anatomic part will be recorded on the roentgenogram.

For uniformity of results the roentgenographic apparatus and processing solutions should be calibrated at regular intervals. Fairly simple methods of calibration, which are accurate enough for the purpose, are described and may be employed in the roentgen department without great outlay of time or money. When properly employed the roentgenograms of a given patient show uniform density from one examination to the next and the detail of the anatomic parts being studied is, as far as the film emulsion is concerned, brought out to the greatest degree.

COURSE: 104

Room: J **Period: W-1**

EDITH H. QUIMBY, Ph.D., New York City

Artificial Atomic Disintegration

This course will be essentially a general descriptive outline of methods of producing atomic disintegration, and of the products thus obtained. Neutrons and artificially radioactive substances will be discussed in some detail. Brief mention will be made of various biological and clinical uses to which these materials have been put, up to the present time.

COURSE: 105

Room: L **Period: W-2**

LAURISTON S. TAYLOR, Ph.D., Washington, D. C.

The Measurement of Quantity and Quality of Roentgen Rays

A general discussion, aimed at showing the necessity for roentgen-ray quantity and quality measurements, will be presented. A brief outline of the fundamental principles involved in the application of roentgen-ray standards will be given. A few examples of actual cases involving the application of physical dosage measurement will be carried through. Likewise the method of determining an absorption curve will be illustrated and the information obtainable therefrom discussed. No discussion of tissue dosage or related subjects will be given.

COURSE: 106

Room: J **Period: Th-1**

J. L. WEATHERWAX M.S., Philadelphia, Pa.

Radium Dosage

A brief discussion of the disintegration cascade of radium; active deposit; differentiation of radium compared to radium emanation or radon; absorption by different filters and thicknesses of filter; half-life and average life of radon; types of radium applicators; interstitial irradiation; expression of dosage in terms of milligram-hours, millicurie-hours; millicuries-destroyed and a discussion of an attempt to express dosage in roentgens.

An outline will be furnished with a bibliography.

COURSE: 107

Room: L Period: Th-2

MARVIN M. D. WILLIAMS, Ph.D., Rochester, Minnesota

Absorption of Roentgen Radiation

1. Introduction. A brief reivew of the wave and quantum theories of radiation and of atomic structure.
2. Absorption. General considerations. Characteristic absorption bands and secondary radiation. Photoelectric absorption. Compton and unmodified scattering. Absorption of high-speed electrons.
3. Applications. The modification of radiation produced by filters. Some primary effects produced in tissue by the absorption of radiation and the dependence of these effects on the quality and quantity of the radiation.

THERAPEUTIC RADIOLOGY

COURSE: 201

Room: S Period: T-1

HARRY H. BOWING, M.D., Rochester, Minn.

Malignant Neoplasms of the Vagina: Diagnosis and Treatment

Anatomically, the vagina, or sheath, forms a canal from the slit of the vulva to the uterine cervix. However, the study of neoplasms occurring in the vaginolabial region will be omitted. The principal discussion will include the malignant neoplasms encountered most commonly in that part of the vaginal tract which begins at the hymenal region, and extends into the wall of the posterior vaginal cul de sac. The pathology, symptomatology, physical findings, differential diagnosis and the management of malignant vaginal neoplasms, together with radiotherapeutic measures, will be reviewed.

COURSE: 202

Room: A Periods: T-2; W-2

E. C. ERNST, M.D., St. Louis, Mo.

Practical Concepts of Radiation Treatment of Carcinoma of the Cervix Uteri

The practical irradiation management of carcinoma of the cervix will be discussed both from the standpoint of the institutional tumor clinic and the private office procedure. Although realizing that the radiation treatment standards continue to remain somewhat in a state of flux and that individualization in the application of roentgen rays and radium is a most essential consideration, nevertheless certain fundamental concepts in our routine procedures are most helpful in the management of cancer of the cervix. These and many other practical therapeutic considerations, including external roentgen therapy, intracavity radium and roentgen methods of treatment and the dosage measurement problems, will be discussed and illustrated.

COURSE: 203

Room: J Period: T-1

H. DABNEY KERR, M.D., Iowa City, Iowa

Roentgen Irradiation of Deep Pelvic Malignant Tumors, Particularly Carcinoma of the Cervix

Although standardized methods of treatment are valuable, it is important to know what is actually being delivered to the lesion, and the response, if we are to make any real advance in our irradiation of pelvic neoplasms. This will be a discussion of the method used in the treatment mainly of carcinoma of the cervix at the University of Iowa. Where possible this consists of the use of nine portals about the pelvis and, in addition, either radium or transvaginal roentgen irradiation according to the method advocated by Merritt and by Erskine. The question of doses delivered to the parametrial extensions and the primary lesion will be discussed in relation to daily dosage division and cumulative dose. An attempt will also be made to correlate delivered dose with clinical result.

COURSE: 204

Room: F Periods: Th-1; F-1

MAURICE LENZ, M.D., New York City

Roentgen Therapy of Cancer of the Larynx and Pharynx

Roentgen therapy of cancer of the larynx and pharynx is influenced by the clinical character, anatomical extent and location, accessibility, invasion of cartilage or bone, infection, ability of the patient to tolerate radiotherapy, and inherent radiosensitivity of the tumor. Technique of treatment also has an important bearing upon prognosis.

All the patients with cancer of the larynx and pharynx treated in the Radiotherapy Departments of Presbyterian Hospital and Montefiore Hospital, New York City, between 1926 and 1939 (approximately 250 cases) have been analyzed in an effort to clarify the relative importance of the factors just mentioned. This analysis, together with data in the literature, forms the basis of this informal discussion. It is hoped that a free interchange of views on details of the problem will take place between lecturer and audience during the course.

COURSE: 205

Room: B **Periods: T-2, Th-2**

T. LEUCUTIA, M.D., Detroit, Mich.

Radiation Therapy of Bone Tumors

(1) Osteogenic sarcoma. Radiation therapy is used in association with surgery in pre- or postoperative form in all types, except the pure osteolytic type, in which it is used alone. In the inoperable group, irradiation produces definite symptomatic relief. The five year survival for the entire series amounts to 17 per cent.

(2) Giant cell tumor. Here radiation therapy is the method of choice. There are two requisities: (*a*) irradiation must be carried out with gradually decreasing doses for nearly two years, and (*b*) a limited use of the affected bone must be made so as to prevent marked demineralization from disuse. The final results are, with few exceptions, good.

(3) Ewing's tumor. In the very early cases, radiation therapy may lead to occasional five year survival; in the others, only palliation is obtained, although the immediate response is often striking.

(4) Multiple myeloma. Radiation therapy leads to limited symptomatic relief, but no cure is possible.

(5) In the group of benign tumors, radiation therapy is of definite value in chondroma, myxoma, hemangioma, cystic conditions, etc.

The detailed procedure is presented in the various groups and the technique of irradiation illustrated. Final statistical data are included.

COURSE: 206

Room: J **Period: T-2**

CHARLES L. MARTIN, M.D., Dallas, Texas

Complete Care of Cancer of Mouth and Lip Including Cervical Metastases with Irradiation Alone

A plan for the complete radiological care of all stages of cancer of the mouth and lip will be described. Although both radium and roentgen rays are used, the equipment is relatively inexpensive and the time of treatment is short. Much emphasis will be placed on the intensive irradiation of metastatic cervical glands, using a combined roentgen-ray and interstitial radium technique, which has yielded some very promising results. Detailed descriptions of the procedure used in a number of actual cases have been prepared for presentation.

COURSE: 207

Room: E **Periods: W-2; Th-2**

E. A. MERRITT, M.D., Washington, D. C.

Technique of Treatment of Cancer of the Cervix and Results Therefrom

This presentation is intended neither as a lecture nor as an instruction course; however, it embraces a complete description of a technique covering the radiation treatment of all stages of carcinoma of the cervix uteri.

The advantages of roentgen over radium therapy will be emphasized and a method of treating the cancerous cervix through specially designed specula will be described.

Hospitalization of the patient is rarely necessary, infection is reduced to a minimum; anesthetics and surgical trauma of the cervix completely avoided; severe roentgen sickness and undue skin reactions almost completely controlled.

It provides the radiologist with a standardized technique which will facilitate future statistical comparisons, and divorces therapy of cancer of the cervix from all of the unnecessary and expensive surgical procedures and dangers associated with the use of radium.

Lantern slides, a wax model, and specula employed will serve to clearly demonstrate the method in actual operation.

Results covering a three year period will be stated.

COURSE: 208

Room: L **Period: W-1**

WILLIAM S. NEWCOMET, M.D., Philadelphia, Pa.

Radium Therapy of Hemangiomata

Recent articles mention the fact that hemangiomata frequently disappear and this has led many physicians to defer treatment. Seventy per cent of these tumors enlarge during the first few months of life. The port wine mark is usually noticed at birth and rarely changes in size. Plea for early treatment. Early methods used in the treatment of hemangiomata. The application of roentgen rays and radium; the differences between them.

Varieties of hemangiomata from the standpoint of pathologist, dermatologist, surgeon, and radiologist.

Possibility of malignant degeneration, those treated by irradiation and those of unknown origin in youth and adult life.

Spontaneous ulceration and ulceration occurring during treatment, other complications; local lack of growth, deformity due to tumor, dermatitis, local and general, telangiectasis and lack of function of affected parts.

Discussion of treatment in the young infant, child and adult.

General review of groups and individual cases with emphasis upon unusual bone change, observed in different types.

Results observed immediately after treatment and ten to twenty years later.

COURSE: 209

Room: I Periods: Th-1; F-1

G. E. PFAHLER, M.D., Philadelphia, Pa.

Radiation Treatment of Cancer of the Breast

The technique for the treatment of cancer of the breast cannot be standardized. The treatment will be demonstrated for cancer of the breast in various stages, including positioning of patient for treatment.

There will also be a demonstration of some of the cases treated primarily and completely by irradiation, also preoperative and postoperative irradiation, including the management of recurrences.

COURSE: 210

Room: J Period: Th-2

U. V. PORTMANN, M.D., Cleveland, Ohio

The Thyroid Gland, Its Anomalies and Diseases

The embryology, anatomy and physiology of the thyroid gland will be discussed in relationship to the etiology and treatment of pathological conditions such as anomalies, diseases attributed to dysfunction and neoplasms.

COURSE: 211

Room: A Periods: Th-1; F-1

GORDON E. RICHARDS, M.D.,
Toronto, Canada

The Treatment of Carcinoma of the Tongue and Buccal Mucosa

The material for this course is based on a careful study of approximately 200 cases of carcinoma of the tongue in which the primary lesion has been treated by irradiation. The irradiation procedures have included radium in a variety of forms from weak seeds to teleradium therapy with a 4 gram radium bomb, and roentgen therapy at all voltages from the Chaoul method to 400 kv. therapy. Complications have been treated both by irradiation and by combinations of surgery and radiotherapy. The cases are thoroughly worked up and certain decisions have been reached which have been agreed to by surgical consultants. The results in this series of cases are distinctly encouraging and I think we are in a position to make quite definite statements on most of the important problems which arise in treating carcinoma of the tongue.

The group of cases of carcinoma of the buccal mucosa is smaller. These cases have also beeen carefully worked up and here, likewise, we have reached conclusions which are encouraging and are somewhat at variance with present day teaching regarding this disease.

COURSE: 212

Room: F Period: T-2

ROBERT B. TAFT, M.D., Charleston, S. C.

Dosage Measurement from a Clinical Standpoint

The author proposes to describe briefly and show photographs of all the methods in use today for roentgen-ray measurement, stating the advantages and disadvantages of each. Illustrations should be obtainable from manufacturers, which will be shown as lantern slides. The value of the "roentgen" as a clinical unit will be discussed. Pros and cons for the direct dosage measurement on the skin of the patient throughout the treatment time will be given. Air measurements versus skin measurements will be outlined and tables given for back-scattering at commonly used wave lengths. Half of the period will be taken up with the above and round table discussion will follow. Throughout all, an earnest effort will be made to keep the matter within the scope of the clinical radiologist who has little knowledge of, or interest in, pure physical measurements. The author, having had some experience in both clinical and physical work, will attempt to narrow the far-too-wide gap between the clinician and physicist.

COURSE: 213

Room: A Periods: T-1; W-1

B. P. WIDMANN, M.D., Philadelphia, Pa.

Radiation Therapy in Cancer of the Skin

Technical procedures for the radium and roentgen treatment of cancer of the skin will be reviewed and analyzed in detail. A definite predetermined plan of dosage has been formulated according to the estimated surface area and thickness of the lesion. Special emphasis will be placed on the value of low voltage roentgen rays (100–135 kv.), and a clinical comparison with radium will be made according to a great variety of patterns for single and multiple radium tubes with different sizes of fields, filters and distances. Conclusions will be drawn from a large clinical experience with massive and fractional doses. Determinations of the "maximum safe dose," the "minimal effective dose," the daily intensity and the probable best rate of administration will be considered with specific recommendations after a routine experience demonstrating results and skin tolerance.

DIAGNOSTIC ROENTGENOLOGY

COURSE: 301

Room: B **Periods: T-1; W-1**

CARL C. BIRKELO, M.D., Detroit, Mich.

Fluorography of the Chest

The technique and equipment required for producing 35 mm. and 4″×5″ fluorograms of the chest will be discussed.

Flat and stereoscopic films will be shown in both the 35 mm. and 4″×5″ sizes made of the same patient on the same day.

Because fluorography has been used chiefly in tuberculosis case finding, its usefulness in this field only will be discussed and as many minimal tuberculous lesions as possible will be shown.

COURSE: 302

Room: A **Period: Th-2**

PAUL A. BISHOP, M.D., Philadelphia, Pa.

Examination and Diagnosis of Lesions of the Temporomandibular Joint

The frequency with which injuries of the temporomandibular joint are overlooked, both clinically and roentgenographically, has led to an appalling number of permanent, serious disabilities of the mandible. A technique for the roentgenographic study of this joint is presented with lantern slide demonstration of acute and chronic injuries, as well as various non-traumatic conditions.

COURSE: 303

Room: B **Period: Th-1**

C. W. BLACKETT, M.D., Boston, Mass.

The Shoulder

The course will be divided into four parts:

1. *Normal motion of the shoulder.* This portion will consist chiefly of a demonstration of the "pivotal paradox" and one must understand the explanation of this in order to appreciate the normal motion of the shoulder.
2. *Complete roentgen examination of the shoulder.* The author will demonstrate the optimum position in which the shoulder should be exposed in order to detect any ordinary lesion of this region in which the roentgen ray helped make the diagnosis.
3. *Pathologic conditions demonstrable by roentgen ray.* This will consist chiefly of a listing of the pathologic conditions which may be demonstrable by roentgen ray. These will be amply illustrated by lantern slides and the more unusual conditions will be demonstrated.
4. *Round table discussion.* The author hopes that each person registering for this course will send to him one question, as this will give him an idea of what is most desired and an attempt will be made to answer these questions during the round table discussion.

COURSE: 304

Room: J **Period: F-1**

FRANKLIN B. BOGART, M.D., Chattanooga, Tenn.

Pulmonary Changes in Some of the Rarer Infectious Diseases

The lung findings in undulant fever, tularemia, psittacosis, Rocky Mountain spotted fever, actinomycosis, blastomycosis, and other infectious diseases will be shown and discussed.

COURSE: 305

Room: C **Periods: T-1; W-1**

RALPH S. BROMER, M.D., Philadelphia, Pa.

The Differential Diagnosis of Skeletal Changes Occurring in Diseases of Infants and Children

The time allotted will be spent in discussing the differential roentgen diagnosis of skeletal changes occurring in diseases of infancy and childhood. All such diseases cannot be included in the time available for the course. Case material will be chosen from the following list: congenital syphilis, rickets, infantile scurvy, tuberculosis, lead poisoning, the blood dyscrasias, xanthomatosis and allied conditions, osteogenesis imperfecta, achondroplasia, multiple enchondromata, multiple cartilaginous exostoses, metastases caused by neuroblastoma, osteochondritis and endocrine disturbances. Wherever possible the early roentgen changes will be emphasized. The question of differential diagnosis will be approached from the standpoint of the predisposition of the various diseases to affect certain bones or certain areas of individual bones. Thus in the case of the long bones, differential roentgen signs of the disease processes in the epiphysis, the diaphysis, the metaphysis, the periosteum, cortex, etc., will be given in detail.

COURSE: 306

Room: C **Period: Th-1**

JOHN R. CARTY, M.D., New York City

Soft Tissue Roentgenography

The pathological and anatomical basis of soft tissue roentgenography is briefly discussed, with particular reference to the newer concepts regarding fascial planes.

The essential points of the technical procedures are discussed and emphasis is placed on the necessity for an adequate understanding of the technical fac-

tors if success in this field is to be expected. Only practical aspects are to be considered, and a simple technical procedure is outlined which may be followed with the equipment found in the average roentgenographic office or department.

Following the discussion of technique the pathological conditions in the soft tissues which may be demonstrated roentgenographically are discussed and divided into appropriate groups, as follows:

Vascular Conditions: Soft tissue roentgenography is valuable in the study of arteriosclerosis and varicose veins. Information may be obtained as to whether or not the deep veins are involved. Occasional valuable information may be obtained regarding arteriovenous aneurysms.

Soft Tissue Tumors: Information regarding the extent and character and whether or not the tumor is malignant may often be secured following roentgenographic examination. It is my opinion that no examination for bone tumor is complete without a soft tissue study also. Differential diagnosis between fibroid periosteal sarcoma and osteogenic sarcoma may sometimes be made. The presence of minute deposits of calcium caused by osteogenic elements in the soft tissues is the deciding factor. These calcium dots are usually entirely obliterated in roentgenograms made for bone detail. In hemangiomata distribution and location of the vessels supplying the tumor can often be ascertained. This may be of considerable value to the surgeon.

Muscle Conditions: Calcified hematomata are well shown in a soft tissue study. Occasionally a ruptured muscle may be demonstrated. Early atrophy at times may be demonstrated before there is actual reduction in size of the limb.

Infectious Conditions: Soft tissue roentgenography is invaluable in the diagnosis of gas gangrene, particularly for determining the extent of the disease. Soft tissue roentgenography is useful in the study of elephantiasis and may help in the differentiation of various types of edema. Soft tissue study of inflamed bursae is helpful, particularly where there is an absence of calcium-like material.

Soft tissue roentgenography of the larynx is briefly discussed, with special reference to carcinoma, edema and retropharyngeal abscesses.

In conclusion, the technique and scope of fasciagraphy is briefly discussed, and films shown which demonstrate its usefulness in certain selected conditions.

COURSE: 307

Room: D **Periods: T-1; W-1**

JAMES T. CASE, M.D., Chicago, Ill.

The Roentgenologic Diagnosis of Carcinoma of the Colon

In the diagnosis of carcinoma of the colon the pathological and anatomical considerations vary according to the location of the tumor in the right or left half of the colon. In colonic polyposis the symptomatology, like the pathology, varies with the position of the tumor in the right or left colon. Special technique is a matter of utmost importance. Repetition of the examination is often necessary.

The technique of examination for and the roentgenologic manifestations of cancer of the colon will be discussed and illustrated.

COURSE: 308

Room: H **Periods: T-2; W-2**

ARTHUR C. CHRISTIE, M.D., Washington, D. C.

The Diagnosis and Treatment of Bronchiectasis

History and Incidence.

Etiology and Pathogenesis.

Diagnosis.

Symptoms and signs. Necessity and means of early diagnosis. Iodized oils. Instillation of iodized oil by the passive method. Description of method. Illustrative slides to show different types of bronchiectasis and conditions which may require differential diagnosis.

Treatment.

Necessity for treating complicating inflammatory conditions. Medication. Postural drainage. Iodized oils. Bronchoscopic drainage.

Surgery: Applicability and limitations. Artificial pneumothorax. Phrenicectomy. Pneumectomy. Roentgen therapy: Rational basis for such treatment. Detailed descriptions of application, dosage, etc. Results illustrated by report of cases.

The aim of this course is to give a complete view of the diagnosis and treatment of this exceedingly common disease in which the radiologist can play an important rôle in both fields.

COURSE: 309

Room: E **Period: Th-1**

LEWIS GREGORY COLE, M.D. White Plains, N. Y.

Tuberculoid Pneumoconiosis

Its Similarity to Pulmonary Tuberculosis, and Its Differentiation from Silicotuberculosis

This course will be considered under the following headings:

A. Etiology
B. Pathogenesis
C. Pathology
D. Course of the disease
E. Similarity to pulmonary tuberculosis
F. Differentiation from silicotuberculosis

The entire subject of pneumoconiosis will be summarized under the heading of "Social and economic justice to labor and management alike, based on scientific facts rather than on sentimental fancies."

COURSE: 310

Room: E **Periods: T-1; W-1**

HOWARD P. DOUB, M.D., Detroit, Mich.

The Invertebral Disc

This discussion will be limited as much as possible to the disc itself, but owing to its intimate relationship to the vertebrae, it will be necessary to consider the spine to some extent.

We wish to present the anatomy of the disc and its vascular supply together with reference to defects in its development which often lead to abnormalities in later life. Changes in the fibrous structure and in the cartilage plates, due either to disease or trauma, will be brought out. The effect of these changes on the vertebral column as a whole will then be considered.

The relationship of the disc to spinal deformities, such as the arthritides, kyphoses, tumors and injuries will also be discussed.

COURSE: 311

Room: I **Period: T-1**

C. G. DYKE, M.D., New York City

The Normal Encephalogram and Ventriculogram

This seminar will deal with the history of pneumoencephalography, the indications and contraindications for the procedure, the reactions to the test, the preparation of the patient, and the roentgen technique. The discussion of the above subjects will be followed by a thorough roentgen study of the lateral ventricles, the basal cisterns and the cortical markings, and also the structures which bound them. The demonstration will be illustrated.

COURSE: 312

Room: C **Periods: T-2; W-2**

C. G. DYKE, M.D., New York City

Pneumo-encephalographic Diagnosis of Brain Tumor

This period will be devoted to an enumeration of the criteria used in the diagnosis of the various types of intracranial tumors. The characteristic changes produced by some of the neoplasms will be emphasized. The demonstration will be fully illustrated.

COURSE: 313

Room: J **Period: W-2**

PEDRO L. FARIÑAS, M.D., Havana, Cuba

Bronchographic Examination in Primary Carcinoma of the Lungs

Bronchographic technique:

Simple bronchography (examination of the trachea and bronchi without contrast media).

Regular bronchography (examination of the trachea and bronchi with an opaque substance).

Mucosography (examination of the tracheobronchial mucosa coated with a very thin opaque layer).

Bronchographic aspects of the infiltrating and polypoid types of tumors.

Comparison between the bronchographic alterations and the anatomical specimen in the different types of bronchial tumors.

COURSE: 314

Room: F **Period: T-1**

JOHN T. FARRELL JR., M.D., Philadelphia, Pa.

Roentgen Diagnosis of Lesions of the Esophagus

The technique of roentgen examination of the esophagus with liquids, semi-solids, and solids, together with the indications and limitations of each, will first be presented. This will be followed by consideration of the roentgen anatomy and physiology. Study of pathological states will embrace the diagnosis and differential diagnosis of congenital, inflammatory, traumatic, functional, and neoplastic conditions of the organ.

COURSE: 315

Room: D **Period: T-2**

GEORGE W. GRIER, M.D., Pittsburgh, Pa.

The Diagnosis of Congenital Heart Lesions in Children

Various malformations and congenital lesions of the heart will be discussed. Lesions which produce characteristic changes will be presented, as well as combinations of lesions. Other lesions in which the roentgen findings and clinical evidence combined will make a diagnosis will also be discussed. Films of a number of cases that have come to autopsy will be presented.

COURSE: 316

Room: B Period: F-1

A. O. HAMPTON, M.D., Boston, Mass.

Technique and Interpretation of Lateral Chest Roentgenography

The discussion will include:

1. Technique of taking roentgenograms in the lateral view.
2. Illustration of normal variations.
3. The importance of the lateral examination of the intrathoracic portion of the trachea, the substernal area and the posterior mediastinum.
4. The shape and location of the various types of consolidation including tumors and infarcts.
5. The appearance of shadows produced by bronchial obstruction and bronchiectasis.
6. A consideration of the interlobar fissures, particularly the importance of change in position associated with alterations in size of the various lobes, secondary to bronchial occlusion and inflammatory disease. The demonstration of emphysematous blebs and cyst-like cavities.

COURSE: 317

Room: E Period: T-2

HUGH F. HARE, M.D., Boston, Mass.

Myelography

Myelography, using either air or oil, may be diagnostic or may be used as an aid to diagnosis. For diagnostic procedures, lipiodol is preferable to oxygen, although the lipiodol procedure requires considerably more time and skill for its use. Oxygen myelography has its advantage in that it is quickly absorbed, but it is an aid to diagnosis rather than a diagnostic procedure. Its main disadvantage is that its use is limited to the diagnosis of lesions of the lumbar region.

COURSE: 318

Room: S Period: Th-1

F. J. HODGES, M.D., Ann Arbor, Mich.

Non-tuberculous Lesions of the Chest

In studying roentgenograms of the chest the likelihood of encountering some form of tuberculosis must always be considered. Often it is difficult or impossible to rule out tuberculosis, but if other pulmonary diseases are kept in mind and if the various types of examination available to the roentgenologist are employed when indicated, the examiner can, in the majority of cases, report either helpful observations or a positive diagnosis to the referring physician. Accordingly, in this course non-tuberculous lesions presenting recognizable roentgenologic signs will be outlined, discussed and demonstrated with examples.

COURSE: 319

Room: C Period: Th-2

E. L. JENKINSON, M.D., Chicago, Ill.
W. H. PFISTERER, M.D., Chicago, Ill.

Diaphragmatic Lesions Producing Gastrointestinal and Bizarre Cardiac Symptoms

Congenital short esophagus and its differentiation from diaphragmatic hernia will be covered. The frequency of hiatal hernia (para-esophageal) will be considered. The importance of the hernia as to the symptoms it may cause will also be discussed. The identification of a hernia is often of paramount importance in ruling out a suspected cardiac lesion. Pain referable to the precordium is often caused by a hernia and it is by no means essential that the hernia be very large. Lesions of the diaphragm will be classified as follows:

1. Congenital short esophagus
2. Para-esophageal hernia
3. Evisceration
4. Absence of the diaphragm
5. Thoracic stomach
6. Eventration

COURSE: 320

Room: S Period: W-1

KARL KORNBLUM, M.D., Philadelphia, Pa.

Tumors about the Sella Turcica

The roentgen examination of the head with special reference to the sella turcica, emphasizing particularly the need of careful roentgenographic technique. The anatomy of the region of the sella turcica will be given and attention directed to the cardinal changes produced by tumors in its vicinity. The characteristic deformities occurring in the intrasellar, suprasellar and parasellar tumors and neoplasms arising in the sphenoid sinus will be considered.

COURSE: 321

Room: F Period: W-2

SHERWOOD MOORE, M.D., St. Louis, Mo.

Technique and Clinical Application of Body Section Roentgenography

The lecture will consist of a brief discussion of body section roentgenography and the methods employed for this purpose. There will be an appraisal, both anatomical and pathological, of the clinical use and value of this method of examination.

COURSE: 322

Room: F Period: Th-2

CARLETON B. PEIRCE, M.D., Montreal, Canada

Bronchographic Technique with Demonstration of the Anatomy and Pathologic Changes of the Bronchial Tree

The preparation of the patient for bronchography, the apparatus used and the various techniques for instillation of iodized oils will be demonstrated and discussed briefly.

Major emphasis will be placed on the demonstration of the topography of the normal bronchial tree, the localization and diagnosis of pathologic changes of the trachea and bronchi.

COURSE: 323

Room: H Period: Th-2

HOLLIS E. POTTER, M.D., Chicago, Ill.

Roentgen Diagnosis of Silicosis

Film and lantern slide demonstration of the essential changes in various stages of silicosis. Differentiation from linear, nodular, and massive lesions caused by other stimuli. Emphasis on the legal aspects of the disease.

COURSE: 324

Room: F Period: W-1

LEO G. RIGLER, M.D., Minneapolis, Minn.

Roentgen Diagnosis of Pleural Effusions

The anatomy, physiology and physical characteristics of the pleura and pleural space will be reviewed. The importance of these factors in the roentgen consideration of pleural collections will be emphasized. Early diagnosis and differential diagnosis of fluids in the pleural cavity, free and encapsulated, will be reviewed. The differential findings exhibited by exudates and transudates and encapsulated collections will be demonstrated. Roentgenologic findings in pneumothorax and its complicated aspects such as adhesions, encapsulations, fluid and mediastinal hernia will be detailed. The technique of the roentgenoscopic and roentgenographic examination of the pleural cavity for disease will be considered.

COURSE: 325

Room: C Period: F-1

SAMUEL A. ROBINS, M.D., Boston, Mass.

Utero-salpingography

This course concerns itself with the roentgen examination of the uterus and tubes by means of opaque media. The subject will be discussed under the following headings: (1) history; (2) apparatus and technique; (3) opaque media; (4) indications; (5) normal morphology; (6) physiologic variations; (7) pathologic variations; (8) pregnancy; (9) tumors (fibroids, polypi, malignancy); (10) inflammatory changes of the tubes; (11) tubal pregnancy; (12) sterility; (13) post-therapeutic changes in the uterus; (14) contraindications; (15) dangers.

Lantern slides of various physiologic and pathologic conditions of the uterus and tubes will be shown to evaluate this method of examination.

COURSE: 326

Room: D Periods: Th-1; F-1

L. R. SANTE, M.D., St. Louis, Mo.

The Pneumonias and Related Inflammatory Processes of the Chest

Lobar Pneumonia: Its mode of onset, course and resolution; roentgenologic characteristics; unusual types of involvement.

Bronchopneumonia—Septic Pneumonia: Roentgenological characteristics and sequelae. The effects of chemotherapy.

Hilar Pneumonia, associated with *adenopathy*, such as tularemic pneumonia, measles pneumonia, etc.

Atypical Pneumonias, such as virus pneumonia; rickettsial pneumonia, etc.

COURSE: 327

Room: S Period: T-2

RICHARD SCHATZKI, M.D., Boston, Mass.

Technique of Examination of the Esophagus and Stomach; Varices; Gastritis

The general principles of the roentgen examination of the esophagus and stomach will be discussed with particular emphasis on the demonstration of the relief of these organs.

Stress will be laid upon the fact that the examination of the relief is a part of the routine examination and not a special type of examination. Exceptions to this rule will be shown.

The roentgen demonstration of esophageal varices and of gastritis will be discussed in more detail: technique; possibilities and limitations of the diagnosis; differential diagnosis; evaluation of the clinical importance of the roentgen examination in cases of varices and gastritis.

COURSE: 328

Room: I **Period: Th-2**

CARLOS H. SCHOTT, D.D.S., Cincinnati, Ohio
EDWARD L. BALL, D.D.S., Cincinnati, Ohio

Radiodontic Interpretation

Operating Room Procedure	Anatomic landmarks
	Positioning of the patient
	Placement and retention of film
	Angulation
	Exposing
	Mounting
	Economics
Interpretation	Children's dentistry
	Operative dentistry
	Periodontia
	Exodontia and oral surgery
	Prosthodontia and crown and bridge
	Orthodontia

COURSE: 329

Room: L **Period: Th-1**

WENDELL G. SCOTT, M.D., St. Louis, Mo.

Technique and Clinical Application of Roentgen Kymography in Diseases of the Heart

The demonstration will consist of a presentation of the basic principles of roentgen kymography and an explanation of the roentgenographic technique. A series of lantern slides will be used to demonstrate characteristic kymograms as seen in:

1. Valvular diseases of the heart.
2. Diseases of the pericardium.
3. Diseases of the myocardium.

The value of roentgen kymography in forming the clinical diagnosis and prognosis in heart disease will be discussed. An effort will be made to present the subject from the practical and clinical viewpoint.

Brief mention will be made of the use of roentgen kymography in diseases of the thorax and of the gastrointestinal tract.

COURSE: 330

Room: B **Period: W-2**

M. C. SOSMAN, M.D., Boston, Mass.

Intracardiac Calcifications

The details of our further experience with intracardiac calcifications, all of which can be found and identified roentgenoscopically. Description of methods of finding the lesions, locating and identifying them. Important points are: (1) preparation of eyes; (2) good roentgenoscopic apparatus, fine focus tube, type B screen; (3) for calcified valves look through the heart along the atrioventricular junction; (4) valves will show as dark, dancing shadows; (5) valves are seen best with a deep, held inspiration; (6) valves are found best in slight right anterior oblique position; (7) valves are identified best in marked left anterior oblique position, the mitral being in the posterior third of the heart shadow, aortic valve in the middle third; (8) other calcified areas which can be found and identified are: (a) calcified coronary arteries, (b) calcified pericarditis, (c) calcified infarcts, (d) calcified endocarditis, (e) calcified tumor.

COURSE: 331

Room: S **Period: Th-2**

W. H. STEWART, M.D., New York City
FRANK HUBER, M.D., New York City

Lesions of the Lower Esophagus and Cardiac Portion of the Stomach

A discussion of the recognition and differential diagnosis of lesions of the lower esophagus and cardiac portion of the stomach.

Carcinoma, diverticula, cardiospasm, peptic ulcer, varices, diaphragmatic hernia, congenitally short esophagus, as well as carcinoma and diverticula of the cardiac portion of the stomach will be discussed and illustrated. In addition to the examples showing characteristic involvement, films will be shown of atypical lesions offering unusual diagnostic difficulties.

The presentation will include an outline of the positions and technique necessary to obtain diagnostic films as well as some discussion of therapeutic procedures.

COURSE: 332

Room: S **Period: W-2**

HARRY M. WEBER, M.D., Rochester, Minn.

Lesions of the Colon Frequently and Easily Overlooked

Advanced pathologic processes occurring in the large intestine usually produce relatively marked morphologic changes in the part of the intestine affected, and so are discovered without great difficulty at roentgenologic examination. Certain clinically important lesions, however, never become large, or produce alarming symptoms even when small, or are encountered so early in their development that very obvious morphologic changes have not as yet taken place, and thus are easily overlooked at roentgenologic examination. This discussion will be limited to the roentgenologic diagnosis of small neoplastic lesions of the large intestine, and to those roentgenologically recognizable changes which signify the earliest manifestations of certain important non-neoplastic lesions of this division of the alimentary tract. The conduct of the roentgenologic

examination of the large intestine will be reviewed briefly, and advantages and limitations of the various diagnostic procedures currently used in this field will be discussed in considerable detail.

COURSE: 333

Room: E **Period: F-1**

GEORGE M. WYATT, M.D., Boston, Mass.

Chest and Heart Diseases in Infants and Children

We arbitrarily divide our patients into two age periods, namely, infants from birth to two years, and children from two years to twelve, because there is a certain age incidence in the diseases encountered. Also because certain diseases, such as tuberculosis, are less easily differentiated in early years of life. Diseases of congenital origin are more likely encountered in the infant. This is particularly true of heart disease. Using lantern slide illustrations we will discuss with as much detail as our time permits the different disease conditions, primary and secondary, congenital and acquired, that affect the heart, lungs, pleura, mediastinum and thorax.

COURSE: 334

Room: I **Period: T-2**

BARTON R. YOUNG, M.D., Philadelphia, Pa.

Roentgen Diagnosis of Diseases of the Air and Food Passages of the Neck; Planigraphy of the Larynx

The normal roentgen anatomy of the soft tissues of the air and food passages is reviewed in detail in the first part of the course. Roentgenoscopy is an indispensable preliminary procedure, so considerable time is devoted to a discussion of this part of the examination. The disturbances in deglutition due to tumor, infection or faulty innervation, and the altered physiology and morphology of the larynx that result from any one of these conditions are readily detected by roentgenoscopic examination, and the roentgenoscopic appearances of some of the more common lesions are shown.

The changes in the air and food passages produced by foreign bodies and inflammatory and neoplastic diseases are demonstrated by exhibiting non-planigraphic and planigraphic roentgenograms. A technique for obtaining posteroanterior studies using non-planigraphic methods is outlined, and the value of this procedure for lateralizing laryngeal lesions is emphasized by showing illustrative cases.

The indications for body section roentgenography, and the results obtained from the application in the neck are presented. Planigraphy is of maximum value in the demonstration of tumors of the larynx but its superiority to conventional roentgen methods is not limited to the larynx. The planigraphic appearance of a number of interesting lesions in the larynx and cervical trachea is shown and discussed.

COURSE: 335

Room: S **Period: F-1**

W. EDWARD CHAMBERLAIN, M.D.,

Philadelphia, Pa.

Technique and Interpretation of Oxygen Myelography

Oxygen has now been used successfully in hundreds of cases as the contrast medium for myelography. It has many advantages over other media but the roentgenographic requirements are very exacting.

Lumbar puncture vs. cisternal puncture for introduction of the oxygen; methods of increasing scope of lumbar puncture route; adaptation of ordinary conventional roentgenographic apparatus to this work; essential factors in technique; stereoscopy essential in lateral as well as dorsal projections; stereoscopic shift across long axis of spine; value of comparing lateral projections with spine in hyperflexion and hyperextension; value of "over-exposing" films; oblique projections of little value except in cervical and upper thoracic regions; suggestions for after-care of patients.

CONDENSED SCHEDULE OF COURSES ON TUESDAY

Code: T-1 **1st PERIOD—8:00 to 9:15** **Code: T-1**

Sequential Courses, Physics and Therapeutic Radiology		Diagnostic Roentgenology	
C—Murphy Morse	Radiologic-Pathologic Conference on Bone Tumors	301—Birkelo	Fluorography of the Chest
E—Wasson	Anatomy of the Lungs	305—Bromer	Differential Diagnosis of Skeletal Changes in Diseases of Children
102—Glasser Portmann	Dosage Measurements with Thimble Chamber: Practical Applications	307—Case	Roentgenologic Diagnosis of Cancer of the Colon
201—Bowing	Malignancy of Vagina: Diagnosis and Treatment	310—Doub	The Intervertebral Disc
203—Kerr	Roentgen Treatment of Deep Pelvic Neoplasms	311—Dyke	Normal Encephalogram and Ventriculogram
213—Widmann	Radiation Therapy in Cancer of the Skin	314—Farrell	Roentgen Diagnosis of Lesions of the Esophagus

Code: T-2 **2nd PERIOD—9:30 to 10:45** **Code: T-2**

Sequential Courses, Physics and Therapeutic Radiology		Diagnostic Roentgenology	
B—Golden Swenson	Roentgenology of the Small Intestine	308—Christie	Diagnosis and Treatment of Bronchiectasis
103—Henny	Roentgen Film Characteristics and Calibration of Apparatus and Developing Solutions	312—Dyke	Pneumo-encephalographic Diagnosis of Brain Tumors
202—Ernst	Radiation Treatment of Cancer of Cervix	315—Grier	Diagnosis of Congenital Heart Lesions in Children
205—Leucutia	Radiation Therapy in Tumors of Bone	317—Hare	Myelography: Technical Procedures and Difficulties Encountered
206—Martin	Radiation Treatment of Cancer of Lip and Mouth, Including Cervical Metastasis	327—Schatzki	Technique of Examination of the Esophagus and Stomach for Varices and Gastritis
212—Taft	Dosage Measurement from a Clinical Standpoint	334—Young	Diagnosis of Diseases of the Air and Food Passages of the Neck: Planigraphy of the Larynx

CONDENSED SCHEDULE OF COURSES ON WEDNESDAY

Code: W-1 **1st PERIOD—8:00 to 9:15** **Code: W-1**

Sequential Courses, Physics and Therapeutic Radiology		Diagnostic Roentgenology	
C—Murphy Morse	Radiologic-Pathologic Conference on Bone Tumors	**301—Birkelo**	Fluorography of the Chest
D—Pendergrass, *et al.*	Panel Discussion of Carcinoma of the Breast	**305—Bromer**	Differential Diagnosis of Skeletal Changes in Diseases of Children
E—Wasson	Physiology and Mechanics of the Chest and Particularly of the Lungs	**307—Case**	Roentgenologic Diagnosis of Cancer of the Colon
104—Quimby	Artificial Atomic Disintegration	**310—Doub**	The Intervertebral Disc
208—Newcomet	Radium Therapy of Hemangiomata	**320—Kornblum**	Tumors about the Sella Turcica
213—Widmann	Radiation Therapy in Cancer of the Skin	**324—Rigler**	Roentgen Diagnosis of Pleural Effusion

Code: W-2 **2nd PERIOD—9:30 to 10:45** **Code: W-2**

Sequential Courses, Physics and Therapeutic Radiology		Diagnostic Roentgenology	
A—de Lorimier Fuchs	Roentgenology of Chest as Outlined by U. S. Army	**308—Christie**	Diagnosis and Treatment of Bronchiectasis
B—Golden Swenson	Roentgenology of the Small Intestine	**312—Dyke**	Pneumo-encephalographic Diagnosis of Brain Tumors
D—Pendergrass, *et al.*	Panel Discussion of Carcinoma of the Breast	**313—Fariñas**	Bronchographic Diagnosis in Primary Carcinoma of Lungs
105—Taylor	Measurement of Quantity and Quality of Roentgen Rays	**321—Moore**	Technique and Clinical Application of Body Section Roentgenography
202—Ernst	Radiation Treatment of Cancer of the Cervix	**330—Sosman**	Intracardiac Calcifications
207—Merritt	Technique of Treatment of Cancer of Cervix and Results Therefrom	**332—Weber**	Lesions of the Colon Easily and Frequently Overlooked

CONDENSED SCHEDULE OF COURSES ON THURSDAY

Code: Th-1 — 1st PERIOD—8:00 to 9:15 — Code: Th-1

Sequential Courses, Physics and Therapeutic Radiology		Diagnostic Roentgenology	
C—Murphy Morse	Radiologic-Pathologic Conference on Bond Tumors	303—Blackett	The Shoulder
E—Wasson	The Classification of Diseases of the Lungs	306—Carty	Soft Tissue Roentgenography
106—Weatherwax	Radium Dosage	309—Cole	Tuberculoid Pneumoconiosis
204—Lenz	Roentgen Therapy in Cancer of the Larynx and Pharynx	318—Hodges	Non-tuberculous Lesions of the Chest
209—Pfahler	Radiation Treatment of Cancer of the Breast	326—Sante	The Pneumonias and Related Inflammatory Processes
211—Richards	Treatment of Carcinoma of the Tongue and Buccal Mucosa	329—Scott	Technique and Clinical Application of Kymographic Studies of the Heart

Code: Th-2 — 2nd PERIOD—9:30 to 10:45 — Code: Th-2

Sequential Courses, Physics and Therapeutic Radiology		Diagnostic Roentgenology	
A—de Lorimier Fuchs	Roentgenology of Chest as Outlined by U. S. Army	302—Bishop	Examination and Diagnosis of Lesions of Temporomandibular Joint
B—Golden Swenson	Roentgenology of the Small Intestine	319—Jenkinson Pfisterer	Diaphragmatic Lesions Producing Gastrointestinal and Bizarre Cardiac Symptoms
107—Williams	Absorption of Roentgen Radiation	322—Peirce	Bronchographic Demonstration of Anatomy and Pathology of Bronchial Tree
205—Leucutia	Radiation Therapy in Tumors of Bone	323—Potter	Roentgen Diagnosis of Silicosis
207—Merritt	Technique of Treatment of Cancer of Cervix and Results Therefrom	328—Schott Ball	Radiodontic Interpretation
210—Portmann	The Thyroid Gland	331—Stewart Huber	Lesions of Lower Esophagus and Cardiac Portion of Stomach

CONDENSED SCHEDULE OF COURSES ON FRIDAY

Code: F-1 **1st PERIOD—8:00 to 9:15** **Code: F-1**

Sequential Courses, Physics and Therapeutic Radiology

C—Murphy Morse	Radiologic-Pathologic Conference on Bone Tumors
E—Wasson	Roentgenologic Diagnosis of Diseases of the Lungs
101—Failla	Some Aspects of Radiosensitivity
204—Lenz	Roentgen Therapy in Cancer of the Larynx and Pharynx
209—Pfahler	Radiation Treatment of Cancer of the Breast
211—Richards	Treatment of Carcinoma of the Tongue and Buccal Mucosa

Diagnostic Roentgenology

304—Bogart	Pulmonary Changes in Rarer Infectious Diseases: Undulant Fever, Tularemia, Actinomycosis, etc.
316—Hampton	Technique and Interpretation of Lateral Chest Roentgenography
325—Robins	Utero-salpingography
326—Sante	The Pneumonias and Related Inflammatory Processes
333—Wyatt	The Heart and Lungs in Children
335—Chamberlain	Technique and Interpretation of Oxygen Myelography

ANNUAL GOLF TOURNAMENT

The Fourth Willis F. Manges Memorial Golf Tournament will be held at the Hyde Park Country Club (ten miles from the Netherland Plaza) on Monday, September 22, 1941, the day preceding the opening of the Annual Meeting of the American Roentgen Ray Society in Cincinnati. The Manges Memorial Trophy will be awarded to the lowest net scorer, who will be given the Trophy for one year and a replica for his permanent possession. There will also be awarded a Kicker's Handicap Trophy which was donated by the manufacturers. Luncheon and dinner will be served at the Club. Non-playing members and guests are welcome at the dinner and it is hoped that a large number will be present. Members desiring to play golf should write to the Chairman of the Golf Committee, Dr. Ellis R. Bader, 927 Carew Tower, Cincinnati, Ohio, enclosing their state or club handicap. Those wishing to attend the dinner only should also send in their names. A charge of $6.00 will cover all day green fee, buffet luncheon and dinner. The charge for dinner alone is $2.00. Return bus transportation will be furnished.

BULLETIN OF THE INTER-SOCIETY COMMITTEE FOR RADIOLOGY

THE EMPLOYMENT OF PHYSICIANS BY HOSPITALS: SOME LEGAL ASPECTS

By MAC F. CAHAL

During the past twenty or thirty years, there have been rapid and extensive changes in the traditional functions of the hospital in its relation to the rendering of medical care by physicians to patients. The nursing home of former times has been superseded by highly organized and heavily financed hospital institutions, admitting both charity and paying patients.

A much larger proportion of sick patients are cared for in the private general hospital today than was the case a generation ago. In 1939, one patient entered a hospital in this country every 3.2 seconds.[1] The American Medical Association lists 6,226 registered hospitals, which in 1939 admitted 9,879,244 patients and recorded the births of 1,096,950 infants.[2] There are at least another thousand institutions properly classified as hospitals which are not registered by the Council on Medical Education and Hospitals of the American Medical Association. These hospitals represent a capital investment of more than three billion dollars.[3]

Out of every dollar spent for medical care in this country, approximately 24 cents goes to pay a hospital bill, either in private or governmental hospitals.[4] This represents a cost of about 656 million dollars per year, of which 300 million is provided by taxes, 302 million by patients' fees, and the remainder by contributions and endowments.[5] The cost of hospitalization as a result of illness is almost as high as the total cost for private physicians' services during a given year.[6]

Growth of Hospitals

It is apparent that the hospital occupies an important rôle in the practice of modern medicine. In assuming this position, the hospital has undergone a rapid metamorphosis in its structural makeup and the position it occupies in the treatment of sickness. The earliest hospitals were usually conceived, promoted, owned and operated by doctors. When, however, the great increase in hospitalization began, and the need for large capital investment in technical aids to the physician became necessary, the interest of agencies and citizens outside of the medical profession was enrolled. Churches, schools and community organizations assumed the financial burden of constructing, equipping and maintaining

[1] *J. Am. M. Ass.*, 1940, *144*, 1157.

[2] *Ibid.*

[3] *The Costs of Medical Care*, Chicago, The University of Chicago Press, 1933, p. 17.

[4] The Committee on the Costs of Medical Care, *Medical Care for the American People*, Chicago, The University of Chicago Press, 1932, p. 15.

[5] Christie, Arthur C. *Economic Problems of Medicine*, New York, The Macmillan Company, 1935, p. 61.

[6] *Medical Care for the American People*, *op. cit.*, p. 15.

hospitals, made more costly by the advent of modern scientific methods.

The influence of the industrial revolution and the urbanization of our population had its effect in increasing the construction and utilization of hospitals. Many illnesses once adequately treated in the home are now referred to the hospital for the comfort of the patient and the convenience of the physician. While perhaps many of these patients could have been saved the expense of a hospital bed and just as satisfactorily treated in their homes, it is not debatable that the hospital has been an important factor in the astonishing improvement in American mortality and morbidity experience and in the rapid progress of medical science.

While this metamorphosis was taking place, the corporation became a new cynosure in American life. The successful business men who were drafted to assist in the financing and administration of new hospitals quite naturally turned to the corporate structure for the organization of the hospital. The striking result was that the hospital, which had once been a private institution operated by a physician or a group of physicians, became in a relatively short time an impersonal organization, operated on big-business lines, enclosed in the legal shell of a corporate charter and administered by a board of trustees not infrequently composed entirely of laymen. To assist the physician in the rendering of his services to patients referred to the hospital, it became uniform practice for the hospital organization to employ and make available to physicians the services of assisting lay and technical personnel. The corporation employed nurses, orderlies, technicians and internes who carried out the instructions of attending physicians and surgeons. Likewise, it purchased expensive equipment which the rapid progress in scientific medicine decreed as necessary in modern practice.

A natural result was the "closed" staff. The hospital board restricted the use of its facilities to certain appointed physicians, and only those doctors in the community holding a position on the staff were permitted to bring their patients to the hospital. This is the customary and almost universal practice of the non-governmental hospital, of which there are 3,554 in the United States.[7]

The voluntary hospital customarily assigned a certain portion of its beds for the use of indigent patients, the cost for which was borne by paying patients and income from philanthropic sources. Members of the staff provided medical services to these patients without charge, and the responsibility for a certain amount of charity work was assumed by physicians appointed to the staff.

Eleemosynary institutions maintained by local or state governments for the care of indigents were usually professionally manned by a full-time staff employed on a salary basis. Private hospitals devoting a portion of their beds to charity patients sometimes employed licensed physicians on a full-time basis to perform the bulk of the charity services.

Employment of Physicians

Having assumed these responsibilities in medical care, it is perhaps not surprising that the hospital soon began to extend its functions, until the corporation itself was engaged in the practice of medicine. Abandoning the old concept that a hospital was a specially equipped building where doctors could treat sick people, many institutions assumed the position of a distributing medium for medical care, obscuring the traditional personal relationship between patients and doctors, and occupying a dominant rôle in the delivery of medical service.[8]

It is now widespread practice for the hospital to employ certain physicians who perform specialized professional services for pay patients who are hospitalized. Sometimes the physician employee is paid a full-time salary by the hospital corpora-

[7] *J. Am. M. Ass., op. cit.*, p. 1159.

[8] Cahal, M. F. The modern hospital and its relation to the practice of medicine. Am. J. Roentgenol. & Rad. Therapy, 1940, *43*, 442.

tion; sometimes he is engaged on a percentage basis, the hospital collecting the fees charged for his services and paying over an agreed percentage to him. Probably the first specialty to feel the impact of this development was anesthesiology. The great increase in surgery contemporaneous with the growth of the modern hospital resulted in the extensive employment of anesthetists by incorporated hospitals. Clinical pathology, too, felt the effects of this trend, and licensed physicians specializing in pathology were employed in large numbers of hospitals. Thus, the hospital assumed the responsibility of providing not only physical equipment to aid the attending physician or surgeon, but employed and made available to him the services of certain specialists whose services were required for a large portion of patients treated in the hospital.

With the spectacular advancement in the science of radiology which came in the beginning of the present century, and the extraordinarily high cost of the mechanical aids necessary in the practice of this specialty, a great many hospitals installed roentgen-ray equipment and employed radiologists on a similar basis. More recently, physicians specializing in other branches of medicine have contracted with hospital corporations and disposed of their services on a salary or percentage basis under a full or part-time agreement with the hospital. If it was expedient for hospitals to employ anesthetists, pathologists and radiologists, it is not surprising that they should also employ surgeons, clinicians, obstetricians and other specialists. There is an unmistakable trend in this direction, the full import of which has only recently been realized.

Taking cognizance of a gradual trend toward the impersonal institutionalization of medicine and the encroachment of hospitals upon the field of private medical practice, interjecting themselves between the doctor and the patient, the Judicial Council of the American Medical Association at its annual meeting in 1936 warned that,

> It would seem that in this time of extensive changes in hospital economics the point had arrived at which further marriages between hospitals and staff physicians that make the doctor of medicine the servant of the hospital should be stopped and a series of attempts at divorce among marriages that have already taken place should be instituted. Our accepted ethical principals are adequate at the present time and hospitals would be of invaluable assistance. It is not an impossible task but will need a militant local and national ethical spirit behind it and a frowning on those individuals in the profession who on personal grounds do not object to the gradual subjugation of the medical profession in the growth of hospital domination.[9]

The principles and ethics of good medical practice require that there be a strong personal bond between the patient and his physician—between the sick man and the one in whose healing power he has confided. Contrary to an erroneous belief by some that the modern practice of medicine is an exact science reducible to mathematics and test tubes, sickness is today more than ever recognized as having an important psychosomatic factor. This essential personal element tends to be destroyed when there is a divided loyalty on the side of the physician. The relationship toward the patient is impaired when the physician is employed by a third party, whether that third party be a corporation or an individual, especially under conditions which permit the employer to obtain a profit from the fees paid for the physician's services. This principle is succinctly stated in the code of ethics of the American Medical Association:

> It is unprofessional for a physician to dispose of his professional attainments or services to any lay body, organization, group or individual, by whatever name called, or however organized under terms or conditions which permit a direct profit from the fees, salary or compensation received to accrue to the lay body or individual employing him. Such a procedure is beneath the dignity of professional practice, is unfair competition with the profession at large, is harmful alike to the profession of medicine and the wel-

[9] *J. Am. M. Ass.*, 1936, *106*, 1197.

fare of the people, and is against sound public policy.[10]

Legal Questions

This new development in the practice of medicine and the new domain assumed by the incorporated hospital present certain interesting questions of law: Is an incorporated hospital which employs a physician on a salary or other stipulated compensation, the corporation itself charging and collecting fees for the physician's services, engaged in the practice of medicine? If the answer is affirmative, another question demands consideration: Is such practice lawful?

A considerable amount of loose thinking has been indulged in by some students who have assayed to discuss these questions. Somewhat typical is the statement by Michael M. Davis, Ph.D., who, in a paper entitled "Do Corporations Practice Medicine?"[11] states that, "Being neither a lawyer nor a physician, I can approach this subject with the ease born of ignorance." He proceeds then to state categorically that, "The hospital corporation, if it is a corporation, is not practicing medicine in a legal sense." He continues by explaining that, "It is not licensed to practice. The legal responsibility remains with the physician, although the degree of legal responsibility of a corporation for profit is, as I have said, larger than that of a non-profit organization." Similarly, the *Journal of the American Hospital Association* has stated that, "The laws regulating the practice of medicine by corporations do not apply and were never intended to apply to hospitals."[12] The fact is that these statements are nothing more than the expression of a wish. An examination of the question from a legal viewpoint and a search of the adjudicated cases establishes that the law holds differently.

Master and Servant

A corporation—and we are in this paper concerned only with incorporated hospitals, not with hospitals owned or operated by private individuals—is a creature of the law that can operate only through the principles of agency. Being an artificial legal entity, it cannot act itself, but only through others.[13] If the physician is regarded as a servant or agent of the corporation employing him, his acts are the acts of the corporation and the corporation is to be regarded as practicing medicine. On the other hand, if the physician is regarded as an independent contractor, his acts are not the acts of the corporation and the corporation is not practicing medicine. This, then, is the question—Is a physician employed by a corporation the agent of that corporation?

The answers to the questions here posed lie in the law of agency. We must therefore turn our attention to a definition of agency and apply it to the case of a licensed physician carrying on his practice under the employment of an incorporated hospital.

There is no great difference in the legal consequences whether we define a physician employed by another as servant or agent. Agents usually create contractual relationship on behalf of the principal. Justice Holmes has said that, "The distinction between a servant and an agent is the distinction between *serving* and *acting for*." Professor Huffcut explains that, "A servant performs operative acts not intended to induce third persons to change their legal relations."

If the parties intentionally do certain acts which have the effect of creating an agency, the relation is established, although they did not actually contemplate such a result, and even though they call the relation something else.[14] A conscious intent to create an agency is not required; agency is created by the relation of the par-

[10] "Principles of Medical Ethics," American Medical Association (1937), Article VI, Section 4.

[11] *Proceedings of the Annual Congress on Medical Education and Hospitals*, 1932, American Medical Association, p. 88.

[12] *Loc. cit.*, June, 1938, p. 65.

[13] See generally, 48 Yale L. J. 346; Notes (1939) 7 Geo. Wash. L. R. 120; (1939) 37 Mich. L. R. 961; (1939) 17 N. C. L. R. 183; N. Y. & N. H. R. R. v. Schuyler, 34 N. Y. 30.

[14] Hughes Lumber Co. v. Madisonville Saw & Planing Mill, 4 La. App. 652; Chandler v. Kelly, 141 S. E. 389.

ties. If the act inures to the benefit of the alleged principal, a presumption of agency is raised.[15]

According to the Restatement of the Law of Agency,[16] an agent is one authorized by another to act on his account and under his control. But the control is less strict than in the case of a servant, and does not include control over physical activities. The liability of a master for torts of his servant is greater than for his agent.

The Restatement is somewhat confusing in the various definitions it sets forth to differentiate between master, agent, and independent contractor. Section 23 states that, "The relationship of master and servant may exist although the law requires the selection of persons for the particular work to be made from a limited class irrespective of how limited the class is, and the master is subject to liability for torts committed within the scope of employment by servants selected from such a class. . . . While the physician employed by a hospital to conduct operations is not in the normal case a servant of the hospital, yet it may be found that the house physician or the internes, subject to direction as to manner in which their work is performed, are servants of the hospital." Obviously, the Restatement is differentiating between paid and unpaid physicians in defining the master-servant relationship.

Statutory Considerations

The question of whether a physician is an agent of the hospital which employs him on a salary was placed squarely before the United States District Court, District of Massachusetts, in *Mallory v. White, 8 Fed. Supp. 989.* Dr. Mallory was a full-time pathologist employed on a straight salary by the Boston City Hospital. He paid a federal income tax on his salary under protest, and then instituted a suit against the local collector of internal revenue to recover the amount so paid. The question was whether or not Dr. Mallory was an officer or employee of a state or a subdivision thereof, so as to render his salary exempt from the federal income tax. The collector of internal revenue contended that he was not an employee, but was an independent contractor whose income was therefore taxable by the federal government. The court found in favor of the plaintiff, however, and ruled that the trustees' right of control over Dr. Mallory's work, whether they exercised that control or not, was entirely consistent with the relation of employer and employee, and that he was therefore not an independent contractor and was not liable for federal income tax on his salary.[16a]

There are several cases holding an employed physician entitled to workmen's compensation for an injury arising out of and in the course of his employment. This conclusion could be reached only if the physician were regarded as a servant and not an independent contractor.[17]

The general rules of agency, therefore, establish the proposition that a physician-employee is agent of his employer and the employer is himself practicing medicine. This is a familiar doctrine in the law of agency: *Qui facit per alium, facit per se.* The agent is the alter ego of the principal and the latter is estopped to deny the agency when the essentials of an agency relation exist and third parties are induced to act with reliance thereon.[18]

To be continued

[15] Neibles v. Minneapolis & St. Paul Ry. Co., 33 N. W. 332.

[16] *Restatement, the Law of Agency*, Sec. 2, Par. 2.

[16a] See Meigs v. U. S. 115 Fed. (2d) 13 (1940), where the same court reached a contrary decision, finding different circumstances from the fact that the hopsital "did not have first call" on the salaried physician who was employed part-time. The differentiation is not entirely convincing.

[17] Bernstein v. Beth Israel Hosp. (N. Y.) 199 N. Y. S. 740; Arquin v. Industrial Commission (Ill.) 181 N. E. 613.

[18] Hannon v. Siegel Cooper Co., 167 N. Y. 244, 60 N. E. 597, 52 L. R. A. 429; Fields, Inc. v. Evans, 36 Ohio app. 153, 172, N. E. 702.

DEPARTMENT OF TECHNIQUE

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THE COPYING OF ROENTGENOGRAMS ON MINIATURE FILM

By MELVIN ASPRAY, M.D.
SPOKANE, WASHINGTON

A SIMPLIFIED method for copying roentgenograms is of obvious advantage to the roentgenologist in establishing a pathological file, completing reports which may be sent to other cities and simplifying and augmenting records for reference purposes. Copying in the past has, as a rule, required elaborate expensive apparatus which has had the further disadvantage of occupying an unnecessary amount of space. A method which I wish to describe utilizes a 35 mm. camera in conjunction with a stereoscope so that very little other equipment is needed and no unnecessary space is required.

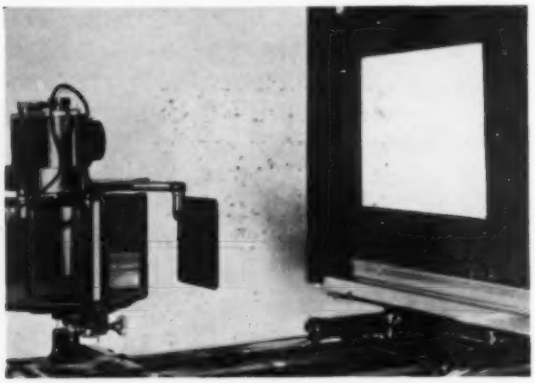

Fig. 1

The 35 mm. reversible film, besides offering an ideal medium for copying, gives the size which can be adapted for projection in the miniature slide projectors. The small films have the obvious advantage of size, lightness, low cost and durability. The problems involved in using the stereoscopic unit with a camera are: (1) A fixed support must be obtained for the camera so that it will be centered fairly closely to the central point of the viewbox. (2) An accessory lens must be adapted to the camera so that the camera can be focused on the viewbox at a distance that will allow complete or nearly complete covering of the major portion of the photographic film when different size roentgenograms are placed in the viewbox. This necessitates different accessory lenses for each size being copied. The first problem is solved by utilizing the eyepiece of the stereoscope as illustrated in Figure 1. A wooden support was made to fit on the top of the eyepiece to hold the camera snugly at right angles to the viewbox. The camera which I used happens to be an Eastman 35 with a 5.6 lens; an expensive camera with a fast lens has no practical advantage. With only the original lens in the camera, the proximal point of centering is 4 feet, and the size of the field covered over twice that of the 14″×17″ film. An auxiliary convex lens must therefore be obtained to shorten the focal length so that a smaller field can be focused at a closer distance. It so happens that the Eastman 7 A portrait attachment when used in conjunction with the regular lens adequately covers a 14″×17″ film when the camera is 25 inches from the film and the focus is set for 4 feet. The viewbox, movable on its rail, offers a source of illumination as well as a means of varying the distance between the camera and film.

The next problem is to determine the correct distance between the viewbox and the camera. With the back of the camera removed, lens opened to its maximum aperture, a piece of ground glass is placed in the film path. The distance can be varied until

sharp focusing is obtained on the ground glass just as is done with a plate back camera. The proper distance can be marked on the viewbox rail. Placing the eyepiece in the center gives a central focusing on the viewbox as regards its left to right dimension. The lower edge of the field of vision covered in my particular instance was slightly above the base of the viewbox so that a $\frac{3}{4}$ inch strip of cardboard was used in the base to elevate the film to a proper position. By this means, a 14″ ×17″ roentgenogram can be re-duplicated in its entirety on a 24×36 mm. film. The parallax error prohibits centering of the film by the eyepiece of the camera. An ophthalmologist can give one much help in grossly determining various lenses for different size fields.* Once a selection of lenses is made, one can center as previously described to obtain a sharp focus in other size fields. Minor variations in the size of the field can be made by changing the distance scale on the camera. When

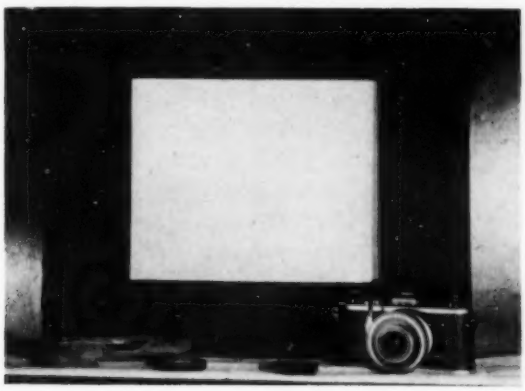

Fig. 2

the camera is set for infinity, the field covered will be slightly larger than when the camera is set for 4 feet.

One difficulty that arises is in the centering on the viewbox. When the camera is in a fixed position on top of the eyepiece, the lowest point of centering when an 8″×10″ or 10″×12″ film is used is appreciably above the base of the viewbox. A cardboard holder covered with black paper makes a satisfactory frame and allows the film to be placed in any desired portion of the viewbox as demonstrated again in Figure 1. The black paper can help the shutters of the stereoscope in cutting out unnecessary extraneous or reflected light.

Fig. 3

Fig. 4

Fig. 5

In the average case, an exposure of two seconds was made with the lens closed to its minimum aperture of F 16. The roll film can be developed by the reversal process by the manufacturer or by local shops. The film can then be cut up and fitted to miniature glass slides. If enough demand for film and processing is made, it may be possible in the future to obtain mounting of the film as is now done with the colored 35 mm. and 40 mm. films.

Figure 2 illustrates the various items which are necessary for this method in addition to the stereoscope.

The procedure described can be adapted to any similar type of stereoscope. It has the advantage of being inexpensive, of taking very little space and allows accurate copying of roentgenograms with a minimum of time and effort.

* I wish to thank Dr. Philip Greene for his assistance.

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ABSTRACTS OF ROENTGEN AND RADIUM LITERATURE

ROENTGEN DIAGNOSIS

GENITOURINARY SYSTEM

Burrell, N. L. Multilocular cysts of the kidney; report of a case. *J. Urol.*, May, 1940, *43*, 656–663.

The term refers to a condition in which a number of small cysts are packed within a single large cyst, and not to polycystic kidney. The individual small cysts have no communication with each other or with the renal pelvis. They contain clear serous fluid. Thirteen cases have been reported. In polycystic kidney the condition is congenital and usually bilateral. The cysts are scattered throughout the renal parenchyma. Multilocular cysts are usually unilateral and are confined to the upper or lower pole. They are also thought to be congenital. The author discusses the various theories as to the etiology of these cysts and gives his opinion that they arise from isolated embryonic tubules which become separated from the parent body. All reported cases were diagnosed either at operation or autopsy. Pyelography should aid in the preoperative diagnosis through resultant pressure defects on the pelvis and calcyces and reduced density of the cystic areas.

The author reports a case in a three year old boy who complained of fever and hematuria. Physical examination revealed an abdominal mass in the left loin. Excretion urography showed secreting kidneys but was unsatisfactory due to the presence of gas and respiratory motion. Pyelogram showed a filling defect in the left renal pelvis. A diagnosis of Wilms' tumor was made and deep therapy administered without effect on the mass. At operation a large cyst of the upper pole filled with smaller cysts was found.—*R. M. Harvey.*

Melicow, M. M., and Gile, H. H. An hypernephroma in a polycystic kidney: review of literature and report of a case. *J. Urol.*, June, 1940, *43*, 767–773.

Out of 14,155 admissions to the urological clinic at Columbia University School of Medicine there were 77 cases of polycystic kidney, 146 cases of renal neoplasm, and only one case in which the two were combined. The authors found no cases of the combined diseases in the literature prior to 1934 and only 4 cases since. Their case was a male, aged sixty-four, who was admitted with sharp colicky right flank pain, referred to the right lower quadrant, hematuria, frequency and urgency. Physical examination disclosed a distended abdomen with a brownish discoloration of the skin over the right side, suggestive of the discoloration following deep irradiation. The right kidney was enlarged. A right-sided pyelogram revealed an irregularly circular collection of dye in the upper pole with an irregular filling defect below. The pelvis and calyces were markedly distorted. Intravenous urography showed an enlarged right kidney with no dye concentration. The left kidney was enlarged, possessed an elongated pelvis and scattered dilated calyces. A diagnosis of congenital polycystic kidney was made with the right a non-functioning kidney. At operation a polycystic right kidney containing a hypernephroma was found. The patient later developed metastasis to the liver and areas of rarefaction in the pelvis suggestive of metastasis.—*R. M. Harvey.*

Anderson, W. A. D. Renal calcification in adults. *J. Urol.*, July, 1940, *44*, 29–34.

Severe calcification of the kidneys has been reported in high intestinal obstruction, following certain chemical poisons, and in hyperparathyroidism. Lesser degrees of calcification have been neglected. These consist of tiny, single or multiple deposits that may be in tubules, interstitial tissue, cortex or medulla. The studies of Randall on calculus formation emphasize the importance of these small calcifications. The author examined the kidneys from 1,500 consecutive autopsies for microscopic calcium deposits. Cases of parathyroid adenoma and bichloride poisoning were excluded. In 180, or 12 per cent, calcium deposits were found. All cases showed some evidence of renal damage, usually vascular. It could not be said that calcium was ever deposited in normal renal tissue. In no case was the calcification as marked as in hyperparathyroidism. The deposits are probably only of consequence when in a renal papilla where, ac-

cording to Randall, they may act as a nidus for stone formation.

The deposits occurred most commonly in calcium-containing casts in the tubule lumen. The cortex of the kidney was involved more often than the medulla. In 2 of their cases a connection was noted with early renal calculus formation, supporting Randall's theory completely. In 2 other cases metastatic carcinoma was present and skeletal metastasis was suspected. Elevation of serum calcium has been reported in such cases.

The incidence of calcification was smaller in children but the calcium deposits were larger.—*R. M. Harvey.*

Rosenow, E. C., Jr. Renal calculi: a study of papillary calcification. *J. Urol.*, July, 1940, *44*, 19–28.

The first study in regard to the origin of renal calculi from a deposition of lime salts on a nidus in the renal papilla was done by Randall. He found calcareous deposition in the papillae in 22.9 per cent and primary calculi in 4.1 per cent. In many instances a small calculus was adherent to a calcified papillary plaque and when the calculus was removed a roughened area on the calculus corresponded to a papillary defect. The author undertook the present study to attempt to confirm this theory. The kidneys from 239 consecutive autopsies were studied by opening the pelvis and entering each calyx. The papillae were examined with the naked eye for calcareous deposits. Cases with advanced destruction or massive calculi were excluded. The presence of lime salts was tested for by the addition of hydrochloric acid ammonium hydroxide to the plaques. The precipitation of typical crystals of calcium phosphate was considered proof of the presence of calcium. The sections were also stained for bacteria.

The size of the plaques varied from 1 to 2 mm. to patches covering the entire papilla. Several cases showed small calculi adherent to the papillae. Calcium was found throughout the medulla but seldom in the cortex. No active infection could be demonstrated near the plaques.

In the 239 cases calcareous plaques were found in 22.2 per cent and actual calculi in 5.4 per cent. These figures correspond closely with those of Randall. Bacteria were found near the plaques in 64.9 per cent of 37 stained sections. The organisms were as a rule diplococci or streptococci. In 19 cases without plaques bacteria were found in only one.

The authors appear to have confirmed the work of Randall in regard to the formation of renal calculi in renal papillae on a nidus of calcareous plaques. The finding of bacteria in such a high incidence of cases suggests that the etiology of the plaques may be infectious.—*R. M. Harvey.*

Koch, Lewis A. Projectile vomiting and intoxication in the newborn infant; report of two cases due to congenital strictures of the urinary tract. *Am. J. Dis. Child.*, Oct., 1940, *60*, 917–922.

Forceful and excessive vomiting is frequently encountered in infants during the neonatal period and is usually due to some disturbance related to the gastrointestinal tract. It may arise from disturbances other than those of the gastrointestinal tract, such as intracranial trauma, which has received considerable emphasis. However, gastrointestinal symptoms in the newborn due to obstructive lesions of the genitourinary system have received almost no mention in the pediatric literature.

Koch reports the clinical courses of two similarly afflicted newborn infants who had projectile vomiting, anorexia, drowsiness and edema during their first weeks of life. In each instance, obstruction of the upper part of the gastrointestinal tract was suspected. However, roentgenographic examinations revealed marked dilatation of the urinary bladder, which was not relieved by voiding. Partial obstruction of the meatus of the urethra was discovered in each patient. Simple dilatation of the stricture was followed by the complete disappearance of symptoms and the prompt recovery of each patient. In the second case, chemical examination of the blood was performed at the height of the symptoms, and no retention of nitrogen was found.

Koch strongly urges that those in charge of newborn infants bear this possibility of urinary obstruction in mind when faced with symptoms which point prominently to gastrointestinal obstruction.—*R. S. Brømer.*

Grajewski, L. E. Congenital hydro-ureter (megaloureter); report of a case. *J. Urol.*, July, 1940, *44*, 54–62.

The author first discusses various theories as to the development of ureteral anomalies. He

has been unable to discover any obstructive lesion in the primary congenital type of bilateral hydro-ureter. Suggested causes are deficiency in development of the musculature of the ureter, failure of appearance of the inhibitory influence on the growth of the ureter which normally appears around the fifth month of intrauterine life and, finally, a disturbed or deficient nervous mechanism.

He reports a case of bilateral congenital hydro-ureter in a twenty-one year old white female. She was admitted to the hospital in a semi-comatose condtion which had existed for twenty minutes. Later she related having experienced sudden severe abdominal pain on the previous day after heavy lifting. The pain had persisted for twenty-four hours. On the day of admission she had lapsed into sudden coma. Physical examination revealed a bilateral symmetrical defect of the iris of both eyes, abdominal tenderness and slight swelling in the left lumbar region. Urinalysis showed 2 plus albumin and 25 to 30 red blood cells per high power field. Phthalein test showed a return of 60 per cent of the dye and the blood urea was 54.6 mg. Drowsiness persisted for four days at which time a convulsive seizure was followed by stupor and severe epigastric pain. A diagnosis of impending uremia was made. Cystoscopy showed clear urine from the right ureter and blood clots and cloudy urine from the left. A retrograde pyelogram was made of the left ureter; 120 cc. of skiodan was injected and a markedly enlarged ureter, measuring 7 cm. in diameter just below the renal pelvis and 2 cm. near the bladder orifice was visualized. A pyelogram of the right side showed a similar, but not so marked, enlargement. There was also a hydro-pelvis but not marked blunting of the calyces.

An interesting lesson to be learned from this case is the occurrence of gastrointestinal symptoms in urinary tract disease on a reflex basis. This patient had had no urinary symptoms but had been operated on for appendicitis, a common history in urinary tract disease.—*R. M. Harvey.*

Brodny, M. L., and Robins, S. A. Urethrography in bulbo-urethral adenitis. *J. Urol.*, June, 1940, *43*, 844–850.

The difficulty in diagnosis of bulbo-urethral adenitis may account for its responsibility as a source of persistent gleet and as a focus of gonococcic reinfection. Infected glands are rarely palpable. The authors suggest urethrography as a valuable measure in the diagnosis and follow-up of bulbo-urethral adenitis. This process is the roentgenological visualization of the urethra by means of contrast media. The procedure should not be employed in the acute or subacute stages of urethral infection.

The technique consists in the injection of 15 cc. of about 20 per cent lipiodol slowly and without force into the urethral meatus with the patient in the left semi-oblique position. The right leg is extended, abducted and internally rotated; the left leg is flexed with the thigh against the abdomen. The central rays are focused midway between the right anterior superior spine and the symphysis. The patient is turned slowly to the dorsal position after exposure of a film and 15 cc. more of medium introduced. A film is then exposed centered 1 inch above the middle of the symphysis.

Normally the bulbo-urethral glands are not visualized by urethrography due to failure of the medium to pass the contracted orifice of the bulbo-urethral duct. This orifice becomes atonic and patulous in the presence of infection of the glands. The author includes urethrograms to show the appearance of the ducts and glands when infected. He also shows serial films to indicate the appearance of progressive healing. The latter is shown by obliteration of the duct and sealing of the gland.—*R. M. Harvey.*

Culver, H., and Baker, W. J. Rupture of the urinary bladder. *J. Urol.*, March, 1940, *43*, 511–531.

The authors report a series of 16 cases of ruptured bladder occurring in a ten year period. The etiology was traumatic in 14 cases and spontaneous in the remaining two. In 10 cases the rupture was intraperitoneal, in 5 extraperitoneal, and in the remaining case a combination of both. The pelvic bones were fractured in 5 cases. The injection of air into the bladder with roentgenoscopy and roentgenograms was of definite aid in diagnosis in 3 cases. In one case air collected under the right side of the diaphragm and in the other instances the pneumoperitoneum was present as collections of air pockets throughout the abdomen. When the rupture was an extraperitoneal one the air was seen in the pericystic region. The authors have never yet seen any complication from the air injection into the bladder or from the ensuing pneumo-

peritoneum. In one case an injection of hippuran into the bladder was followed by a spray of the medium into the peritoneal cavity. The roentgen ray was of aid in making the diagnosis in 7 of the 16 cases.—*R. M. Harvey.*

McCown, P. E. Carcinoma in exstrophy of the bladder. *J. Urol.*, April, 1940, *43*, 533–542.

Carcinomatous degeneration of the mucosa of an exstrophic bladder is rare. The literature includes reports on 24 cases. Exstrophy of the bladder occurs only once in 50,000 births, of which only 10 per cent live to reach the cancer age. The author reports an additional case. The patient presented himself with an ulcerating mass in the lower abdominal wall, biopsy of which revealed an adenocarcinoma of the bladder. Intravenous urography showed bilateral hydronephrosis and hydroureter. The patient showed marked improvement following bilateral ureterostomy. The mass was too extensive to justify excision. In response to the patient's insistent demand that something be done a large portion of the mass was removed with the "radioknife." The patient died of postoperative shock. The best treatment for this condition, according to the case reports, appears to be excision or irradiation or both.—*R. M. Harvey.*

Gilbert, J. B. Studies in malignant tumors of the testis; differential diagnosis of clinically obscure tumors: four cases and review of 122 from the literature. *J. Urol.*, May, 1940, *43*, 722–733.

Early diagnosis of testicular tumors is seldom made in spite of the accessibility of the scrotum to palpation. The author reports 4 cases. The first was a typical seminoma. The patient's chest was negative for metastasis and after operative removal of the testis high voltage irradiation consisting of 195 r each was delivered to the right scrotum, and abdomen to the diaphragm, and the left scrotum to the umbilicus. Seven years later he was still free from evidence of disease. The second case was an embryonal carcinoma which was removed and the patient given 46 deep radiation treatments to the scrotum and anterior and posterior abdomen. He was alive and well more than two years after irradiation. The third case was an embryonal carcinoma which received prophylactic irradiation totalling 6,800 r following operation. He was alive and well nineteen months later. The fourth case had a chorionepithelioma with diffuse metastases at postmortem.

The author reviews 126 cases from the literature of which 46 were unicellular, 71 were teratoid, and 9 were simply designated as malignant tumors. In the unicellular group 28 per cent survived three or more years, and 22 per cent survived five or more years. In the teratoid group only 11 per cent survived more than thirty-two months. The Aschheim-Zondek test was of aid in making the diagnosis in 21 of 53 cases since Zondek's first report in 1932.

Irradiation was administered in 40 patients, roentgen radiation in 38 and radium in 2 cases. All were treated by postoperative irradiation, and only 4 received preoperative irradiation. The prognosis is much better in seminomas than in teratomas.—*R. M. Harvey.*

Counseller, V. S., and Bedard, R. E. Sarcoma of the prostate gland. *J. Urol.*, June, 1940, *43*, 836–843.

One hundred and sixty verified cases have been reported of sarcoma of the prostate. Round cell sarcoma is the most common and spindle cell sarcoma next in frequency. The majority of the patients have been under forty with 50 per cent of the cases under twenty. Carcinoma of the prostate, on the other hand, rarely, if ever, occurs under the age of forty. Hence a prostatic tumor in a patient under the age of forty, if malignant, is probably sarcoma. The duration of life after the diagnosis has been made averages nine months regardless of treatment. A few cases of permanent cure have been reported following irradiation.

Nine cases of prostatic sarcoma have been found at the Mayo Clinic. These were all verified; an additional 20 cases have been so diagnosed but not verified. The author summarizes 4 cases which have been verified since a previous publication of 5 earlier cases. The diagnoses were fibrosarcoma, rhabdomyosarcoma, lymphosarcoma and leiomyosarcoma. One case was untreated, one was treated with radium packs at a distance and intrarectal radium, and the other 2 cases received deep roentgen therapy. The results were not encouraging. The authors recommend partial prostatectomy followed by radium and roentgen irradiation immediately as the best treatment.—*R. M. Harvey.*

Stevens, A. R., and Barringer, B. S. Sarcoma of the prostate. *J. Urol.*, July, 1940, *44*, 83–108.

The diagnosis of sarcoma of the prostate, in the experience of the authors, is usually made

late and the course of the disease rapidly downward. Roentgen therapy occasionally produces temporary regression of the growth. They suggest the following pathological grouping: (1) leio- and rhabdo-myosarcoma, originating in the musculature of the prostate; (2) lymphosarcoma, arising from the lymphoid tissue; and (3) sarcoma of undetermined origin—spindle, fibro, myxo, round and giant cell sarcomas. Clinically they have added a fourth group, anaplastic carcinoma, which is not sarcoma at all.

According to Ewing the rhabdo myosarcoma is the only well defined variety of prostatic sarcoma. Lymphosarcoma is very rare and Ewing believes that most cases so reported are actually very anaplastic small cell carcinomas. He states that sarcomas of undetermined origin are usually bulky, soft and vascular, Anaplastic carcinomas are commonly misdiagnosed as sarcoma. This mistake is commonly made from the clinical appearance.

Metastasis from prostatic carcinoma is usually through the lymphatics but may occur by the blood stream. The reverse is true in sarcoma. Sarcoma of the prostate metastasizes to the lungs, kidneys, liver, pleura, regional lymph nodes and spleen. Bone metastases are common contrary to the belief held by some authors that lack of bone metastases can be used as a differential point between sarcoma and carcinoma of the gland. The round and spindle cell types are the most malignant.

Suggestive clinical signs of prostatic sarcoma are earlier age than occurs in prostatic carcinoma and hypertrophy, rapid growth with short history, large size of the gland, and irregularity of the growth. The differential diagnosis should include prostatic abscess, carcinoma, bladder tumor, prostatic cyst, and massive prostatic calculus. Diagnostic roentgen therapy is valuable, 300 r daily to four portals until a total dosage of 1,200 r to each portal has been given. This should cause marked recession in three to four weeks. Aspiration biopsy is also of definite value in the diagnosis.

In regard to treatment the patients fall into two clinical groups, one in which it is evident that a highly malignant prostatic tumor is present, and the second, in which malignancy is revealed only by histological examination of a gland removed by prostatectomy under the mistaken diagnosis of benign hypertrophy. The latter are usually of low grade malignancy and not radiosensitive. These cases may be watched for recurrence or irradiated if indicated by histological examination. External irradiation must be supplemented by interstitial. In the highly malignant group operation is contraindicated. The authors suggest a type of irradiation for these patients such as is employed in Wilms' tumors of the kidney. The theory is to produce slow vascular sclerosis by prolonged external irradiation. They suggest 200 r daily at 70 cm. distance to four or five portals for six or more months. No other factors are given.

The article then summarizes 16 cases of prostatic sarcoma from various New York hospitals. Some form of irradiation was employed in all but 3 cases. The results of the various types of irradiation given were not especially encouraging but the authors feel that irradiation is superior to surgery and that the type of irradiation given to Wilms' tumors should be employed.—*R. M. Harvey.*

SKELETAL SYSTEM

Olcott, Charles T. Arachnodactyly (Marfan's syndrome) with severe anemia. *Am. J. Dis. Child.*, Sept. 1940, *60*, 660–668.

Olcott reports the case of a girl of sixteen years of age having arachnodactyly with the usual features of Marfan's syndrome, namely, long thin bones, kyphoscoliosis, congenital cardiac anomalies and cloudiness and displacement of the lenses of the eyes. In addition she had congenital dislocation of the hip, a misplaced kidney and atrophy of the frontal lobes of the brain. Cysts were present in the thyroid and pituitary glands, and the ovaries contained an abnormally small number of follicles, but no etiologic significance was attributed to these abnormalities of the endocrine glands. The patient had a severe anemia of secondary type, with greatly diminished hemoglobin. The bone marrow contained an increased number of normoblasts and primitive erythroblasts. He presents evidence indicating that arachnodactyly with the anomalies associated with it in this case is an anomaly of development especially manifest in the middle germ layer.—*R. S. Bromer.*

Engel, D. Etiology of multiple deformities. *Am. J. Dis. Child.*, Sept., 1940, *60*, 562–579.

Engel advances a new theory for the morphogenesis of dysostosis multiplex (the Pfaundler-Hurler syndrome). He assumes that all signs of this disease are caused by the damaging effects of blebs of the cerebrospinal fluid which

has escaped from the medullary tube into the subcutaneous tissue through the foramen anterius in early embryonic life. This theory is based partly on experiments of Bagg and Little and partly on clinical findings.

He discusses nine other syndromes: (1) oxycephaly (Virchow), (2) acrocephalosyndactyly (Apert), (3) dysostosis craniofacialis (Crouzon), (4) Laurence-Moon-Biedl syndrome, (5) Morquio's disease, (6) pleonosteosis familiaris (Léri), (7) mongoloid idiocy, (8) craniocarpotarsal dystrophy and (9) H. H. Turner's syndrome. Nearly all of these syndromes have in common an incomprehensible combination of some anomaly of the skull with one or another deformity of the extremities. In some of them the cranial deformity is the dominant feature; in others it is the peripheral anomalies. Engel considers these nine other syndromes to be different manifestations of the same etiologic factor involved in the causation of dysostosis multiplex. He proposes the name of "bleb" diseases for this group, and suggests that the bleb of cerebrospinal fluid plays an important part in the etiology of single and multiple deformities.—*R. S. Bromer.*

Pellini, Maria, and Calvino, Marcella. Contributo allo studio radiologico e anatomo-istologico dell'osteopecilia (osteopatia condensante disseminata). (Roentgen and anatomo-histological study of disseminated condensing osteopathy.) *Radiol. med.*, Aug., 1940, *27*, 632–645.

The author describes a case of disseminated condensing osteopathy in a boy eleven years of age who died of medulloblastoma of the left hemisphere of the cerebellum. As he had been having attacks of vomiting, the gastrointestinal tract was examined; the appendix was injected and there were shadows caused by calcified mesenteric glands. There were also shadows due to condensation of bone in the last two lumbar vertebrae, the right wing of the ilium and sacrum, the acetabulum, and the ischiopubic branch of the os pubis. This led to an examination of the whole skeleton, and foci of condensing osteopathy were found in localizations not generally affected by this disease, such as the ribs and the spinal column. They were also found in the skull and the left scapula and humerus and the largest and densest ones in the head and intertrochanteric region of the right femur, and the neck of the left femur.

As it was thought that the bone disease might be a metastasis from the brain tumor sections of the affected bones were carefully examined histologically but there was no evidence of new-growth. The affected zones were systemic in distribution, irregular in outline and quite large. The histological examination showed that some of them originated from the marrow and some from the periosteum, and in one place a bridge of condensed bone was found connecting two foci from these two different origins.—*Audrey G. Morgan.*

Cossu, Didaco. Fratture del sopracciglio cotiloideo con sublussazione femorale. (Fracture of the rim of the acetabulum with subluxation of the femur.) *Radiol. med.*, Aug., 1940, *27*, 653–654.

A miner, aged forty-four, was going through a narrow passage with a weight on his shoulder when he fell, striking the anterior surface of his thigh against a car of mineral that was passing by. At the time of the accident the injured limb was in semiflexion and the trunk thrown backward. He immediately had intense pain in the hip and loss of function of the leg. There was slight shortening of the limb, which appeared to be completely rotated outward, and pain on any attempt at movement. Roentgen examination showed fracture of the external third of the rim of the acetabulum with slight upward dislocation of the head of the femur, though it was not outside the joint cavity.

There are very few fractures of this type. Only 71 have been reported in the literature. They are generally caused by a fall on the feet, the knee or the great trochanter, the head of the femur striking on the rim of the acetabulum and breaking it. Generally the head of the femur passes entirely outside the joint cavity. Usually reduction and immobilization with a cast is sufficient treatment. Operation is justified only by irreducible dislocation.—*Audrey G. Morgan.*

Benassi, Enrico. Frattura isolata del cuboide. (Isolated fracture of the cuboid.) *Radiol. med.*, July, 1940, *27*, 578–579.

Fractures of the cuboid bone alone are quite rare. Such fractures are almost always due to direct violence and the cuboid is so well protected by the surrounding bones that it is hard to fracture it without multiple fractures of the tarsus and metatarsus, particularly the os calcis and the fifth metatarsal.

The author describes a case in a workman, aged twenty-seven, who fell from a height and his right foot underwent a distortion in forced adduction. When he was examined thirteen days later there was marked swelling of the whole foot and moderate pain when he bore his weight on the foot. Pressure with the finger on the right lateral margin of the fifth metatarsal caused intense pain. Roentgen examination of the whole foot showed a solitary subperiosteal fracture at the base of the tuberosity of the cuboid without any marked separation of the fragments. It was evidently an avulsion fracture caused by a pull on the strong inferior calcaneo-cuboid ligament (great plantar ligament) caused by a forced movement of adduction and medial rotation at Chopart's joint.—*Audrey G. Morgan.*

Hefke, H. W. Roentgenologic study of anomalies of the hands in one hundred cases of mongolism. *Am. J. Dis. Child.*, Dec., 1940, *60*, 1319–1323.

Hefke reports the results of a study of the hands of 100 typical mongolian imbeciles. The ages of the patients ranged from two months to forty-six years; there were 72 children between the ages of two months and fifteen years and 28 adults above fifteen years.

He found an anomalous middle phalanx of the fifth finger in 62 of the 100 cases. In 30 cases he found other anomalies, mainly so-called pseudo-epiphyses of the first and second metacarpal bones. Of the children with mongolism, 73 per cent showed some abnormality of the bones of the hand.

The osseous development was normal in 79 per cent of the children, advanced in 14 per cent and delayed in 7 per cent.

Hefke states that all authors agree on the general clinical appearance of the hands. They are much shorter and broader than normal. The tips of the fingers are usually slender.—*R. S. Bromer.*

BLOOD AND LYMPH SYSTEM

Dykstra, O. H., and Halbertsma, T. Polycythaemia vera in childhood; report of a case with changes in the skull. *Am. J. Dis. Child.*, Oct., 1940, *60*, 907–916.

The authors report the case of a child with polycythemia vera and tower head. The patient died at the age of twelve years of an intercurrent disease after an observation period of seven years. At autopsy a marked thickening of the skull cap was found. On a roentgenogram of the skull taken six years before, scarcely any such change was perceptible. This thickening of the skull also occurs in the erythroblastic anemia of Cooley, in sickle cell anemia and sometimes in ordinary hemolytic anemia. A connection between the disease of the blood and the change in the skull may be assumed in polycythemia as well as in the three mentioned anemias.—*R. S. Bromer.*

Wallgren, Arvid. Systemic reticuloendothelial granuloma; nonlipoid reticuloendotheliosis and Schüller-Christian disease. *Am. J. Dis. Child.*, Sept., 1940, *60*, 471–500.

During the last few decades morbid conditions in the reticulo-endothelial system have been described and have been labeled with the names of the research workers who first investigated the different types of disease—Gaucher's disease, Niemann-Pick's disease and Schüller-Christian's disease. The latest addition to these diseases is that named Letterer-Siwe's disease by Abt and Denenholz. Siwe has divided into two groups the diseases of the reticulo-endothelial system which do not belong to the Gaucher, Niemann-Pick and the Schüller-Christian types: (1) cases in which an acute infection was present which was regarded as the cause of the disease and (2) cases in which no positive evidence could be found of the presence of an etiologically significant infection. The two types mentioned, infectious reticulo-endotheliosis and the second, or Letterer-Siwe's disease, have been combined under the name of nonlipoid reticulo-endotheliosis, in contradistinction to Schüller-Christian's disease which is classified among the general xanthomatoses on account of the lipoid content of the infiltrations of reticulum cells. According to Siwe, the disease defined by him is characterized by: (1) enlargement of the spleen and liver; (2) hemorrhagic diathesis, chiefly manifested by petechial exanthema or purpura; (3) general enlargement of the lymphatic glands, as a rule not pronounced in vivo and seemingly of noninfectious origin; (4) secondary anemia of a progressive type, generally with a normal leukocyte count; (5) occurrence, neither hereditary nor familial, exclusively in infants and young children, unknown etiology, fatal prognosis and variable duration (from a few weeks to several years); (6) local-

ized skeletal changes in the form of tumorous formation or osseous lesions in some cases, and (7) general hyperplasia of the cells of the reticulo-endothelial system which may focally assume a tumor-like proliferation, especially in the spleen, liver, lymphatic glands, thymus, skin and bone marrow, and usually signs of a hemorrhagic tendency but no constant storage of fat, lipoid or Gaucher's substance in the cells.

Wallgren supports the theory that nonlipoid reticulo-endotheliosis and Schüller-Christian disease are identical and that so-called infectious reticulo-endotheliosis, Letterer-Siwe's disease and Schüller-Christian's disease are different types of the same malady. He describes 2 cases of systemic reticulo-endotheliosis, the patients being four months and two and a half years of age, respectively. These cases show great similarities, and he thinks occupy intermediate positions, one of them between so-called infectious reticulo-endotheliosis and Letterer-Siwe's disease and the other between the latter condition and Schüller-Christian's disease.

In this paper, Wallgren discusses in detail the three types of reticulo-endotheliosis hitherto regarded as different diseases and advances reasons to show that the distinguishing features between infectious reticulo-endotheliosis and Letterer-Siwe's disease are rather arbitrary and nonessential and that the anatomic and clinical dissimilarities that may exist between nonlipoid reticulo-endotheliosis and Schüller-Christian's disease are easily explained by the difference in age of the patients, the unequally malignant or benign course, mainly due to this difference in age, and the different localization of the morbid changes. Transitional types are found between characteristic cases of Schüller-Christian's disease and Letterer-Siwe's disease and also between those of the latter and so-called infectious reticulo-endotheliosis.—*R. S. Bromer.*

Petersen, G. Fr. Hochgradige periphere Mediaverkalkung in je einem Fall von Hyperparathyreoidismus und Hypernephrom. (Extreme peripheral calcification of the media in a case of hyperparathyroidism and in one of hypernephroma.) *Acta radiol.*, 1940, *21*, 21–31.

In a series of roentgen examinations of cases of arteriosclerosis, the author found 2 cases in which the calcification of the media in the arteries of the extremities was unusually extensive and intense. The first of these cases was one of hyperparathyroidism in a woman thirty-four years of age. It is well known that hyperparathyroidism is an unusual disease; only relatively few cases have been described in the literature, and the deposition of calcium in the walls of the arteries is mentioned in only a few of these. The second case was in a working man sixty-three years of age who died after an operation for hypernephroma. In both cases roentgen and histological examinations showed typical calcification of the media.

There was no doubt of the cause of the calcification in the first case. In the second it seems questionable whether the calcification was caused directly by the hypernephroma. But the case is interesting from the fact that the calcification was much more intense than in any other of the more than 300 cases in patients from forty to more than eighty years of age in which the author has made a roentgen demonstration of calcification in the arteries of the extremities. He calls attention to the fact that it is possible that the calcification of the media of the arteries of the extremities which is commonly considered more or less normal in old people may be caused by disturbances of function of the parathyroid and suprarenal glands. —*Audrey G. Morgan.*